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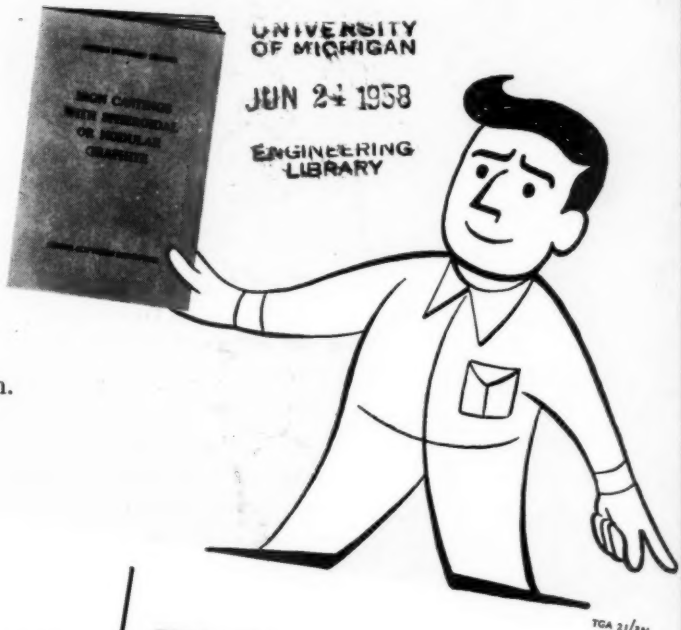

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By W. T. Pell-Walpole, D.Sc.

The paper represents a continuation and development of the Author's work on the relationship between pouring temperature and the soundness and mechanical properties of de-gassed bearing bronze, which was presented in a previous issue of the JOURNAL. The present study records a further investigation in which are examined a wider range of bronze compositions in current use as foundry alloys 681

Methods of Manufacturing Small Machine Components

By R. Schwalbe and P. Weist

Casting processes such as shell moulding, plaster moulding and so on have made it possible to produce in the foundry small machine parts requiring a degree of precision not obtainable by traditional methods. The Paper which was first presented at the European Investment Casters conference in 1957, compares the main processes at present employed in this field and attempts to evaluate their particular usefulness 687

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Influence de la Composition sur la Non-porosité et les Propriétés de certains Bronzes de Fonderie. Par W. T. Pell-Walpole, D.Sc.
L'article continue et développe les travaux de l'auteur sur la relation existant entre la température de coulée et la non-porosité ainsi que nous avons présentés dans une édition précédente. L'étude actuelle représente une investigation plus approfondie dans laquelle est examinée une plus grande variété de compositions à base de cuivre en usage courant comme alliages de fonderie 681

Einfluss der Zusammensetzung auf die Druckdichtigkeit und die Eigenschaften einiger Gussbronzen. Von W. T. Pell-Walpole, D.Sc.
Der Artikel stellt eine Fortsetzung und Weiterentwicklung der Arbeit des Verfassers dar, welche in einem früheren Heft edieser Zeitschrift beschrieben wurde und die Beziehungen zwischen Giesstemperatur einerseits, und Druckdichtigkeit und mechanischen Eigenschaften anderseits, von entgasten Zinnbronzen behandelt. Die gegenwärtige Untersuchung erweitert den Kreis der überprüften Kupferlegierungen solcher Zusammensetzungen, die als Giessereilegierungen gebräuchlich sind 681

Méthodes de production de petites pièces de machinerie. Par R. Schwalbe et P. Weist.
Les procédés de coulage tels que le moulage en carapace, le moulage par plâtre etc. ont redu possibles la production en fonderie de petites pièces de machinerie demandant un dégré de précision qu'on ne peut pas obtenir par les méthodes traditionnelles. L'article qui fut d'abord présenté en 1957 à la conférence des fondeurs utilisant la méthode de moulage à la cire perdu, compare les procédés principaux employés actuellement dans ce domaine et essaie de comparer leur utilité particulière 687

Verfahren zur Erzeugung kleiner Maschinenbestandteile. Von R. Schwalbe und P. Weist.
Neuzeitliche Giessverfahren, wie z.B. das Formmaskenverfahren, das Giessen in Gipsformen und dgl., haben es möglich gemacht, in der Giesserei kleine Maschinenbestandteile zu erzeugen, die ein hohes Mass von Genauigkeit erfordern, das mit den traditionellen Methoden nicht erzielt werden kann. Der Vortrag, welcher zuerst auf der Europäischen Konferenz der Feingiessbetriebe im Jahre 1957 gehalten worden war, vergleicht die wichtigsten auf diesem Gebiete derzeit angewandten Verfahren und versucht, deren spezielle Nützlichkeit zu bewerten 687

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FOUNDRY
TRADE JOURNAL

Vol. 104 JUNE 5, 1958 No. 2173

Keeping Up with the Jones's

It is often asserted that American economy is largely influenced by the desire of Mr. and Mrs. Smith also to possess the latest acquisitions made by Mr. and Mrs. Jones. Within reason this system has merit, providing that the Jones's make their purchases prudently, and that their emulators are like minded. We have no knowledge as to whether or not this ambition extends to industry, particularly to foundries, yet there is good reason to believe that it does. It being impossible to learn what the Jones's foundry is doing, except by hearsay, we often read of groups of American founders deciding to reveal their own costs of manufacture and to learn those of their colleagues in the industry. Thereafter, the case of keeping up with the Jones's must naturally follow, with a better contribution to the national economy than is the case in the domestic purchases rivalry.

"Keeping up with the Jones's" creates fashions, and looking back upon the foundry industry over many years, it is easy to detect the influence of fashion, plus salesmanship. There was a time when "semi-steel"; powdered-fuel-fired rotary melting furnaces; teeming iron into hot moulds to yield a pearlitic structure and pencil ingates, all swept the industry—all with good results. As fashions have a way of running in cycles, some of these may once again make headlines; others have of course just been a jumping-off ground for further progress.

Probably the greatest need in the direction of emulating the Jones's relates to the foundry industry as a whole. It has made some progress since the time, many years ago, we announced that we would "blue pencil" any reference to its being a "Cinderella" industry,—yet as an industry it is still insufficiently aggressive. Recently, Lord Hives, in an after-dinner speech, read out a very long list of bodies associated with technical education and those represented on the committee charged with the duty of laying down conditions for the award of the Dip.Tech., remarking on the lack of support on these bodies from the foundry industry. A similar omission of foundry associations was—and probably still is—to be noticed in the list of learned societies published in the almanack generally used as a reference when searching for the exact titles and addresses of such bodies. The foundry industry needs to take steps to acquire prestige with the general public equal to that enjoyed by the chemical and iron and steel industries—it certainly merits it.

Industrial Film Conference

At a conference on the use of the industrial film in technical education organized by the Midland Industrial Film Association recently held at the G.K.N. Group Research Laboratory at Wolverhampton, short papers were read by Mr. Marriott, deputy director of training. Stewarts and Lloyds, Limited, Dr. N. A. Dudley, head of the Department of Engineering Production, University of Birmingham, and Dr. H. I. Stonehill, Medway College of Technology, Chatham. The discussion was opened by Dr. J. Wilson, director of education and training, British Motor Corporation. Amongst conclusions reached were: (1) Satisfactory films for use in practically every branch of technical teaching are scarce, and the documentation in most fields is bad. (2) There are many films which contain short sequences which could be of value in teaching, but since the majority of the material is irrelevant there is a reluctance to use the film, even where the existence of the vital section is known, and (3) it is worthwhile examining the possibility, in the broadest sense, of making more technical film of the right type available to teaching institutions. The accent should be in the first instance on the needs of the West Midlands Area.

A working group consisting of two representatives from technical education and two from the Midland Industrial Film Association was appointed with the following broad terms of reference: To examine and report on the availability of films and to advise on their future provision where most needed.

Institute of Indian Foundrymen

The Institute of Indian Foundrymen held its first major convention last February and its proceedings have just been published in the *Indian Foundry Journal*. Taking the form of an exhibition and symposium, it was opened by Prof. M. S. Thacker, with Sir J. J. Ghandy in the chair. In welcoming the delegates, Dr. B. R. Nijhawan pointed out that the symposium had attracted delegates from many parts of the world. Amongst these were Mr. Charles H. Wilson, vice-president of the Institute of British Foundrymen, and Mr. G. L. Hancock, president of its Sheffield branch.

The exhibition, larger than originally expected, had 25 exhibitors, about one quarter showing actual castings. Many would-be exhibitors had to be refused owing to the shortage of space.

The dinner held in connection with the conference attracted over 250 people. Both Mr. Wilson and Mr. Hancock figured as speakers. During the function, Sir J. J. Ghandy was presented with an illuminated framed certificate as Patron of the Institute of Indian Foundrymen, the presentation being made by Mr. N. G. Chakrabarti, the president.

Latest Foundry Statistics

Ironfounding: Employment as at March 29, was, according to the Council of Ironfoundry Associations, lower than either a month or a year earlier. The survey showed 126,646 men, 9,118 women, giving a total of 135,764 in employment. A month ago it was 137,652 and a year ago 138,507.

B. & F. Golf Competition

The annual golf tournament for the McKenna Cup, organized last Friday by Bradley & Foster, Limited, Darlaston, this year drew a larger number of competitors than in any previous contest, there being no fewer than 62 golfers participating. It was held in very favourable weather on Whittington Barracks Course, near Lichfield. The winner this year was Mr. R. R. Dunn, of the Sheepbridge group, with a score of 70 net, followed by Mr. K. P. Staves of Grazebrook Foundry, Limited, as runner up, and Mr. W. H. Timmins, of Lloyds Bank, in third position.

At the dinner in the evening, at which the company were hosts in the George Hotel, Lichfield, no fewer than 118 were present. Mr. Harmar Nicholls, M.P., J.P., Parliamentary Secretary to the Minister of Works, was chief guest, and he it was who, after the dinner, presented the trophy to the winner and prizes also to the runners-up. After the loyal toasts, Mr. G. E. Lunt, managing director of Bradley & Foster, who presided, first gave the list of apologies, included amongst whom were Dr. J. E. Hurst, who had been chairman at the dinner on previous occasions, and Mr. M. Froggart, managing director, and Mr. J. P. Hunt, chairman of the Staveley group of companies. He also mentioned the recent retirement from Staveley of Mr. T. A. McKenna, donor of the Cup. At this stage in the proceedings, Mr. Lunt was pleased to voice the thanks of the assembly to his fellow director, Mr. Allen, and the staff of Bradley & Foster, who had made all the arrangements for the event. Introducing Mr. Nicholls, Mr. Lunt explained that although he was M.P. for Peterborough, he was actually Darlaston born. He then congratulated the winners, and said it was pleasant to record that they had entered into the competition for the first time this year.

The illustration shows Mr. Harmar Nicholls, M.P. (third from the left), presenting the McKenna Cup to Mr. R. R. Dunn, the winner of the Bradley & Foster golf competition. Others in the picture are Mr. K. P. Staves (right), the runner up, and Mr. G. E. Lunt (left), managing director, Bradley & Foster, Limited, who presided at the dinner.

Effects of Composition on Soundness & Properties in Some Foundry Bronzes*

By

W. T. Pell-Walpole

The following research paper deals specifically with mould reaction, and the use of protective dressing to eliminate this, in relation to alloy characteristics and composition. It represents a continuation and development of the Author's work previously reported in the JOURNAL†. *In his earlier study he gave an account of the main factors contributing to unsoundness and loss of strength in sand-cast test-bars of de-gassed bearing bronze. These were shown to stem from variations in pouring temperature. Here he comments on data obtained for a wider range of bronze compositions which are in current use as foundry alloys.*

Introduction

An earlier investigation on the relationship between pouring temperature, soundness and mechanical properties in sand-cast test-bars of de-gassed bearing bronze (10 per cent. tin, 0.75 per cent. phosphorus) showed that the principal factors contributing to unsoundness and loss of strength were related to pouring temperature in the following manner:—(*a*) Solidification shrinkage produces a gradual linear increase of porosity as the pouring temperature is increased. (*b*) Mechanically-entrained bubbles of air or gas are a factor only with very low pouring temperatures near to the liquidus of the alloy. (*c*) The steam generated from the uncombined moisture in the sand contributes to porosity and its effect increases regularly with rise of pouring temperature. (*d*) Reaction between the molten bronze and the combined water of the sand-mould occurs when a critical pouring temperature 1,050 deg. C. is exceeded, and becomes the dominating factor when this temperature is exceeded by more than 25-30 deg. C. (*e*) The critical pouring temperature can be raised to 1,150 deg. C. by dressing the mould (Bromsgrove green-sand 6½ per cent. moisture) with a dressing of 10 per cent. plumbago, 10 per cent. powdered alumina in tar oil. This treatment also neutralizes the effects of free moisture of the mould, probably by generating insoluble gases which exert a scavenging action on the molten metal during pouring.

Whether moulds are used as prepared or with a surface dressing, it appears that the range of pouring temperature over which the mould reaction does not occur, corresponds with the long-established idea of a "safe range" of pouring temperatures, and that the dressing quoted extends the "safe range" by approximately 100 deg. C. The present paper records an investigation in which the findings summarized above are examined for a range of bronze compositions in current use as foundry alloys.

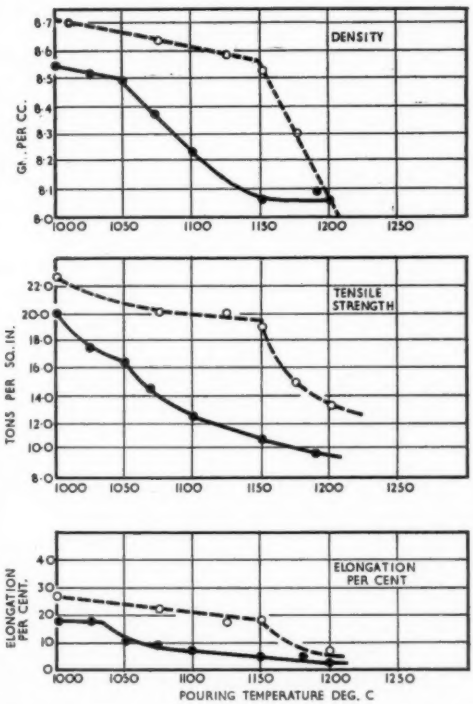


FIG. 1.—*Results of density determinations and tensile tests for test-bars of high-phosphorus bearing bronze (tin 10 per cent., phosphorus 0.75 per cent.).*

Key:— ——— bars cast in undressed moulds; – – – – bars from moulds dressed with tar oil/alumina dressing. Each point plotted represents the mean of two observations.

* The Author is attached to the University of Birmingham. He was born in 1912 and educated at Dudley Grammar School and Birmingham University. After graduating in 1933 he proceeded to research work sponsored by Tin Research Institute and carried out in the Department of Metallurgy, Birmingham University, as Bowen Research Scholar to the degree of PH.D. (1936) and later as Research Assistant to the late Professor D. Hanson. He was awarded the Thomas Turner Bronze Medal for research in 1938. He joined the Tin Research Institute staff at Greenford in 1939 and became chief metallurgist in 1940. He was released from this post to accept election to ICI Research Fellowship (1948) but continued to work in close collaboration with the Institute on problems of sand-casting tin-bronzes.

† See FOUNDRY TRADE JOURNAL, March 31, 1955, **98**, 341.

Effects of Composition on Foundry Bronzes

The principal aims were as follows:— (1) To examine how the safe range of pouring temperature varies with composition. (2) To determine whether there was any extension of the safe range, and improvement of the properties when the moulds were dressed with alumina dressing. (3) To study the relation between porosity and properties.

The alloys selected for this comparative study were:— (*a*) High-phosphorus bearing bronze:— Tin 10 per cent. Phosphorus 0.75 per cent. (*b*) Medium-phosphorus bearing bronze:— Tin 10 per cent. Phosphorus 0.35 per cent. (*c*) Admiralty gun-metal:— Tin 10 per cent. Zinc 2 per cent. Phosphorus nil. (*d*) Leaded gunmetal:— Tin 5 per cent. Zinc 5 per cent. Lead 5 per cent. Phosphorus 0.05 per cent. (*e*) High-lead bronze:— Tin 5 per cent. Lead 20 per cent. Phosphorus 0.05 per cent.

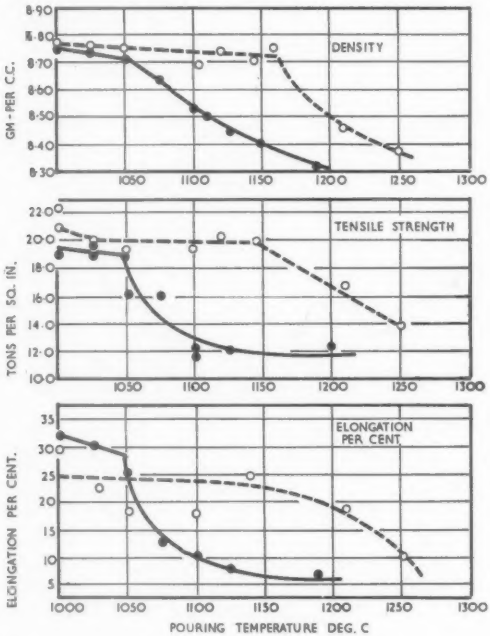


FIG. 2.—*Results of density determinations and tensile tests for test-bars of medium-phosphorus bearing bronze* (*tin* 10 *per cent., phosphorus* 0.35 *per cent.*). *Key as in Fig.* 1.

Experimental Procedure

Ten melts each of 9 kilograms (approx. 20 lb.) were prepared for each composition, the following melting procedure being used for each charge. The electrolytic copper was melted in a Salamander crucible under a 3 per cent. cover of an oxidizing flux (cupric oxide one part, fused borax one part, sea sand one part) in a gas-fired furnace. After the required super-heating (which varied according to the pouring temperatures to be used for the given melt), the flux was thickened with dry sea sand and removed, and the necessary additions of Chempur tin, phosphor-copper (15 per cent.), pure lead or pure zinc were made. From each melt two bars were poured at different temperatures, so that from the ten melts duplicate bars were obtained for 10 different temperatures ranging in 25 deg. C. intervals from 1,000 to 1,250 deg. C.

The moulds were prepared from Bromsgrove red sand with 6½ per cent. moisture for top-poured DTD (Directorate of Technical Development) test-bars since these had been found to be most satisfactory for this type of investigation. The whole course of experiments was then repeated, using moulds dressed with a paint consisting of 10 per cent. powdered alumina, plus 10 per cent. plumbago in a tar oil carrier. The heads of the castings were removed and surfaces were cleaned by shot-blasting, before the determination of apparent density by the Archimedes method. A thin disc was then cut from each bar and then from the remainder a standard tensile test-piece was prepared (0.564 in. dia., 2 in. gauge length). In addition to density determinations and tensile tests, macro and micro-examinations were made on one bar of each pair, but these will not be discussed in detail.

The results of density determinations and of the tensile tests are plotted in Fig. 1-5. The continuous lines represent the results for bars cast in undressed moulds, the broken lines those for the bars from the moulds dressed with the tar oil/alumina dressing. Each plotted point represents the mean of two observations. The variations of individual results from the plotted mean values were relatively slight being of the order of ±0.05 gm./cc. for density figures, ±1.0 ton per sq. in. for tensile strength values, and ± 5 per cent. for elongation values.

Discussion of Results

Bars Cast in Undressed Moulds

The curves of density against pouring temperatures all show the same general characteristics, namely, a very gradual fall as the temperature is increased to a critical value which varies from alloy to alloy, then a rapid fall in density for any further rise of pouring temperature. Thus each curve shows a marked inflexion point at the critical temperature which indicates the onset of the mould reaction for that particular alloy.

The lowest pouring temperature used in this investigation does not lead to the formation of porosity by the entrapping of air bubbles, except in casting of low-tin leaded gunmetal which has a higher liquidus temperature than any of the other alloys. With this alloy the density curve passes through a shallow maximum at pouring temperature of 1,050 deg. C. With lower pouring temperatures a slight fall in density is caused by mechanically entrained air or gas bubbles.

The curves for tensile strength and elongation all show a more or less marked inflexion at the same critical temperature as that on the corresponding density curve, with marked deterioration of

properties when the critical pouring temperature is exceeded. That portion of each curve below the critical pouring temperature, however, takes on one of two possible forms according to composition. Thus the bronzes of high- and medium-phosphorus content (0.75 per cent. or 0.35 per cent. phosphorus respectively) give curves of similar form to the corresponding density curves showing a gradual fall in both strength and elongation values as the pouring temperature is increased up to the critical level. The other bronzes examined which are phosphorus-free or contain only a sufficient phosphorus content for deoxidation differ markedly from this form, in showing flat *maxima* on strength and elongation curves, at some temperature below the critical value.

These discrepancies between the variation of mechanical properties with pouring temperature, and the corresponding variation of density are caused by the sensitivity of the former to structural changes other than the variation of the amount of porosity. Thus as pouring temperature is increased the amount of the metastable hard ($\alpha + \delta$) constituent decreases, leading to an increase in deformability and in capacity for work-hardening, and a consequent improvement in tensile strength and elongation values. Simultaneously, with this structural change there is an increase in porosity as pouring temperature is raised, and this increase tends to restrict the amount of deformation which the bronze can undergo before fracture and hence to reduce tensile strength and elongation values.

The resultant effect of a change in pouring temperature on mechanical properties thus depends on the balance of the two opposing factors. It appears that as the pouring temperature is raised from the lowest value practicable, the decrease in ($\alpha + \delta$) constituent gives an improvement in strength and ductility which is greater than the accompanying deterioration produced by the increase in shrinkage porosity. At higher temperatures, however, the increase in porosity becomes more marked and overrides the structural improvement. Thus at some temperature in between the lowest practicable and the figure at which the mould reaction sets in, the curves of elongation and strength show slight *maxima*. This effect is most marked in the Admiralty gunmetal (which has the highest equivalent tin content of the series) and is less pronounced in the low-tin low-phosphorus bronzes.

In the medium- and high-phosphorus bronzes, the change in the amount of ($\alpha + \delta$) with pouring temperature has little effect on properties since these compositions contain a larger amount of an equally embrittling constituent (Cu_3P) which does not vary in quantity with pouring temperature. The properties of these bronzes consequently vary directly with variations in the amount of porosity present, so that the curves for tensile strength and elongation do not show the *maxima* found in the case of the low-phosphorus bronzes, but are similar in form to their associated density curves throughout the whole range of pouring temperatures, *i.e.*, properties decline gradually as the temperature is raised to the critical value for the onset of the mould reaction, and then fall away very rapidly as this temperature is exceeded.

Critical Pouring Temperature and "Safe Range"

The critical pouring temperature for the onset of the mould reaction, as indicated by the inflexions on the graphs of density and tensile strength, increases regularly as the phosphorus content of the bronzes falls, from 1050 deg. C. for 0.7 per cent. phosphorus to 1200 deg. C. for a phosphorus-free gunmetal. The variation of tin content and the presence of either zinc or lead, separately or together, seems to have little effect on the reaction temperature.

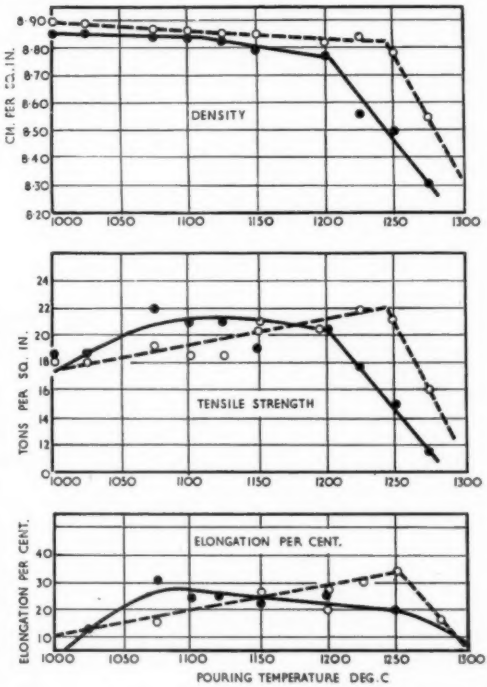


FIG. 3.—*Results of density determinations and tensile tests for test-bars of Admiralty gunmetal (tin 10 per cent., zinc 2 per cent., phosphorus—nil). Key as in Fig. 1.*

From these observations it appears that the critical temperature for reaction is not controlled directly by the chemical composition of the bronze, but by some secondary characteristic of the alloy which is very sensitive to phosphorus content, but relatively insensitive to tin, zinc, or lead content. Further, since the mould reaction is likely to occur rapidly only when molten metal is in contact with the mould the controlling factor is likely to be associated with the solidification characteristics of the alloy. The characteristics involved are extent of the freezing range, the liquidus temperature, the

Effects of Composition on Foundry Bronzes

solidus temperature and the way in which some of these functions vary for a given composition with rate of solidification. A study of these characteristics in relation to the observed variations of the critical temperature, reveals a strong correlation between the latter and the effective solidus tempera-

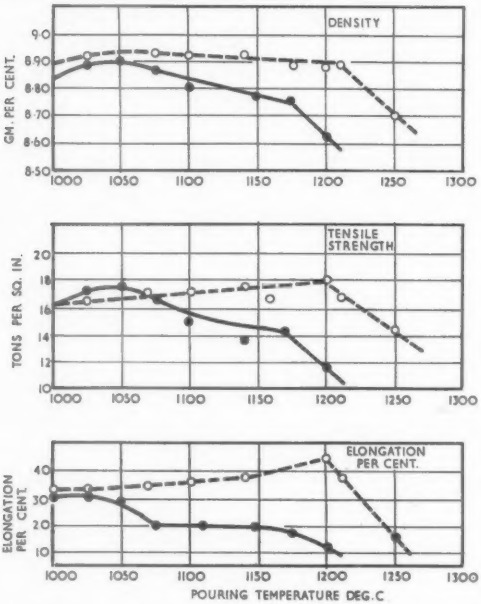


FIG. 4.—*Results of density determinations and tensile tests for test-bars of leaded gunmetal (tin 5 per cent., zinc 5 per cent., lead 5 per cent., phosphorus* 0.05 *per cent.). Key as in Fig.* 1.

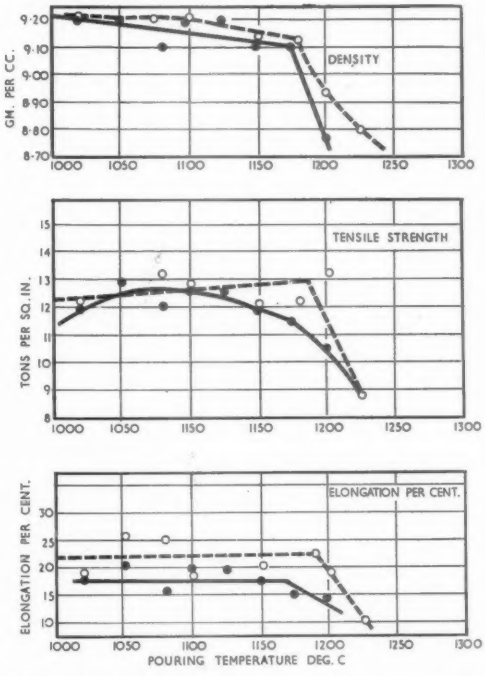
ture, *i.e.*, the solidus temperature appropriate to the rate of solidification involved. This may be appreciably lower than the solidus indicated by the equilibrium diagram. (In leaded bronze the solidus temperature involved is that of the copper-bearing phases only: the fact that the isolated pools of lead-rich liquid do not solidify until the alloy has cooled to 327 deg. C. seems to have no effect on this relationship). Under the cooling rates produced by the Bromsgrove green-sand mould all the low-phosphorus alloys examined contain greater or smaller amounts of ($\alpha + \delta$) eutectoid, produced by the decompositions $\beta \rightarrow \gamma \rightarrow (\alpha + \delta)$. These alloys therefore complete their solidification at the Liquid + $\alpha \rightarrow \beta$ peritectic reaction. The temperature of this reaction is $\sim$ 800 deg. C. for binary tin-copper alloys, and only changes slowly as zinc is substituted for tin, or as lead is added. Additions of phosphorus, on the other hand, produce a very rapid lowering of the solidus temperature to a minimum of 637 deg. C. corresponding to a ternary reaction Liquid + $\alpha \rightarrow \beta + Cu_3P$. This constant temperature reaction is reached when the phosphorus content of a 10 per cent. tin-bronze is raised to 0.35 per cent., and further increase of phosphorus to 0.7 per cent. gives no change from this temperature (Fig. 6). Thus the solidus temperatures of the bronzes examined in this investigation are closely related to their phosphorus contents, decreasing from 800 deg. C. for 0 per cent. phosphorus to 637 deg. C. for the bronzes containing 0.35 per cent. and 0.7 per cent. phosphorus respectively.

If the solidus temperature (S) is plotted against critical pouring temperature (C) a linear relation is obtained (Fig. 7) such that

$$C = S + 400 \text{ deg. C.}$$

i.e. the mould reaction does not occur unless the pouring temperature employed is at least 400 deg. C.

FIG. 5.—*Results of density determinations and tensile tests for test-bars of high-lead bronze (tin 5per cent., lead* 20 *per cent., phosphorus* 0.05 *per cent.). Key as in Fig.* 1.



above the solidus temperature of the bronze. The temperature interval between the solidus and the pouring temperature will determine the time for which molten metal is in contact with the sand-mould, and it is suggested therefore, that the time corresponding to a temperature interval of 400 deg. C. is the minimum time required to heat the mould surface to that temperature at which the combined moisture present can react rapidly with the molten metal, thus introducing large volumes

of hydrogen into the metal and causing extensive porosity during subsequent solidification.

The safe range of casting temperature for a given bronze will extend from the critical pouring temperature down to lowest pouring temperature, which will avoid air-traps or a mis-run. The lower limit of this range for any alloy will be closely related to its liquidus temperature. From available data it is clear that for the range of bronzes examined liquidus temperatures vary only within much narrower limits than do the corresponding solidus temperatures. Thus increase of phosphorus content from zero to 1.0 per cent. depresses the liquidus of a tin bronze by only 50 deg. C., compared with 160 deg. C. for the depression of its solidus temperature. Consequently the pouring temperature of a high-phosphorus bronze can only be reduced by ~ 75 deg. C. (allowing for the increased fluidity with increased phosphorus content). In consequence the safe range of pouring temperatures diminishes rapidly as phosphorus content increases, as is well known in bronze-foundry practice, and has been shown quantitatively by the curves for density and mechanical properties in Figs. 1-5.

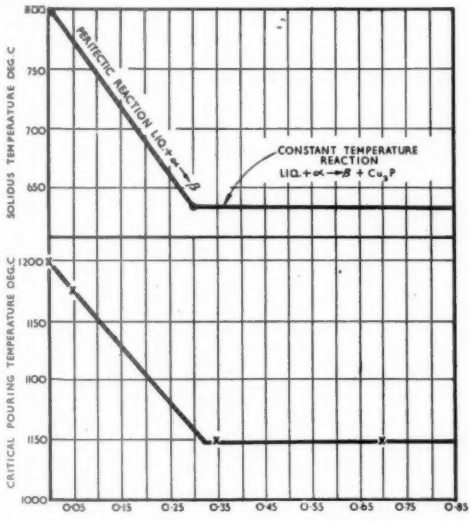


FIG. 6.—(a) *Effect of phosphorus content on solidus temperature of* 10 *per cent. tin bronze cast in sand moulds and* (b) *variation of critical pouring temperature with phosphorus content of bronze.*

Bars cast in dressed moulds

The curves of density against pouring temperature for bars cast into moulds dressed with tar-oil/alumina (broken lines, Fig. 1*a*-5*a*) show that the critical temperature is raised appreciably by the dressing, for all compositions except the high-lead alloy (Pb – 20, tin 5, phosphorus 0.05 per cent.) The extent of the change for different alloys is shown in Table 1.

Consideration of the way in which the critical temperature for dressed moulds varies with composition suggests that the dressing acts simply as a mechanical barrier between molten bronze and sand wall and that this barrier breaks down when the pouring temperature exceeds a critical value

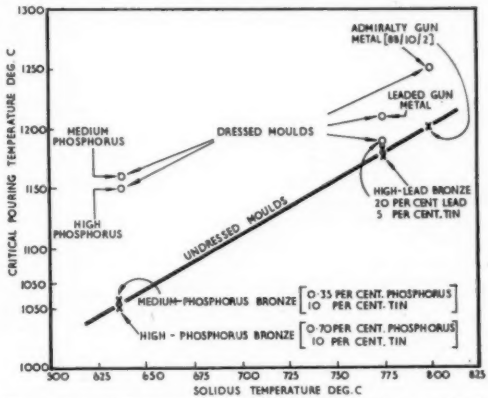


FIG. 7.—*Solidus temperature plotted against critical pouring temperature of foundry bronzes.*

which is not related directly to the solidus of the alloy in the same way as the critical reaction temperature for the undressed mould, but depends on some other characteristic which varies with composition.

TABLE 1.—*Increase of Critical Temperature Resulting from Alloy-Dressed Moulds.*

Alloy.	Critical temperature.		Increase of critical temperature.
	Undressed mould.	Dressed mould.	
Higher-phosphorus bronze	1,550 deg. C.	1,150 deg. C.	100 deg. C.
Medium-phosphorus bronze	1,050 ,,	1,160 ,,	110 ,,
Admiralty gunmetal ..	1,200 ,,	1,250 ,,	50 ,,
Leaded gun-metal	1,175 ,,	1,210 ,,	35 ,,
High-lead bronze ..	1,175 ,,	~1,185 ,,	>10 ,,

* Each containing 0.05 per cent. phosphorus.

Since the break-down temperature is highest with the phosphorus-free gunmetal and lowest with the very fluid high-phosphorus bronze it seems likely that the penetrating power of the molten alloy is the governing factor. The intermediate values for the low-phosphorus leaded gunmetal and the medium-phosphorus bearing bronze are in accord with this suggestion. The high-lead bronze is more penetrative than a low-lead bronze of equivalent phosphorus content, and again the break-down temperature for the dressing with this alloy is consistent with this explanation. Since the reaction temperature for this bronze in the uncoated mould does not differ significantly from the break-down temperature of the dressing, the latter gives no effective extension of the safe-range with this alloy.

The curves of mechanical properties against pouring temperature for test-bars cast in the dressed moulds (broken lines Figs. 1*b*-5*b*, and 1*c*-5*c*) show that the high- and medium-phosphorus bronzes are markedly improved by the

Effects of Composition on Foundry Bronzes

dressing, giving values for tensile strength per sq. in. of 20 tons and over 15 per cent. elongation, for all temperatures up to those at which the protection breaks down.

The gunmetal and leaded gunmetal differ from the phosphorus bronzes in having rather poorer properties from the dressed moulds than from the undressed, when the pouring temperature is below 1,150 deg. C. or 1,100 deg. C. respectively. The probable explanation of this is that the low gas content absorbed from the free-moisture of the undressed moulds ensures a more uniform distribution of porosity in these alloys. The dressing exerts a scavenging action on the molten bronze, removing the absorbed hydrogen, and leaving the residual shrinkage porosity concentrated at the axis of the bar, and therefore exerts a more harmful influence on the mechanical properties of the tensile test-bar from which the very sound outer layers have been machined. When the pouring temperature is high enough to cause the gas porosity from the free-moisture of the undressed moulds to exceed this effect of the dressing, then the bars from dressed moulds are superior.

The beneficial effect of the decreasing amount of $(\alpha + \delta)$ n the properties of bars cast from successively higher temperatures is very notable in the bars from the dressed moulds, and optimum properties are obtained when the pouring temperature is just below the break-down temperature for the dressing, *e.g.* Admiralty gunmetal poured at 1,225 deg. C. gives 21-22 tons per sq. in., 30 per cent elongation on 2 in. Leaded gunmetal (85/5/5/5) poured at 1,200 deg. C. gives 18 tons per sq. in., 4 per cent. elongation on 2 in. The high-lead gunmetal shows more improvement in mechanical properties than might be expected from the slight improvement in density which the dressing effects, and gives consistent results of 12-13 tons per sq. in. with 18-25 per cent. elongation for all casting temperatures up to 1,200 deg. C.

Conclusions

Conclusions may be summarized as follow:—(1) The rapid deterioration in density and mechanical properties which sand-cast bronzes and gunmetal suffer when the pouring temperature exceeds a critical value is associated with the onset of the mould reaction. (2) The critical pouring temperature for the reaction to occur is directly related to the solidus of the alloy and is therefore very sensitive to its phosphorus content, since prosphorus has a more pronounced effect on solidus temperature than any of the other possible constituents. (3) The available range of pouring temperatures from the lowest which will give freedom from mis-runs up to the temperature at which the reaction occurs constitutes the " safe-range " of the alloy. (4) A mould wash of 10 per cent. Al_2O_3, 10 per cent. plumbago in tar-oil, raises the critical temperature for reaction and thus extends the safe-range appreciably for phosphorus bronzes and gunmetals, but is relatively ineffective with a high-lead bronze. (5) If bronze is de-gassed before pouring and D.T.D. test-bar moulds are used, dressed as indicated above, then any pouring temperature within the extended safe-range for the alloy will give a high-density bar with mechanical properties well above the minimum required by the appropriate specification, *e.g.*:—

Medium- and high-phosphorus 10 per cent. tin bronzes:—20 tons per sq. in., 15 per cent. elongation, if poured at 1,000-1,150 deg. C.

Admiralty gunmetal (88/10/2):—19-21 tons per sq. in., 15-30 per cent. elongation, if poured at 1,050-1,250 deg. C.

Leaded gunmetal* (85/5/5/5):—17-18 tons per sq. in., 30-40 per cent. elongation, if poured at 1,050-1,200 deg. C.

High-lead bronze* (20 lead 5 tin):—12-13 tons per sq. in., 18-25 per cent. elongation, if poured at 1,050-1,200 deg. C.

Acknowledgments

This research was carried out for the Tin Research Institute to whom the Author is indebted for financial assistance and for permission to publish the results.

* Containing 0·05 per cent. phosphorus

Halifax Firm's Development Plans

Two Halifax engineering concerns, the Asquith Machine Tool Corporation, Limited, and Hartley's Malleable Fittings Company, Limited, are reported to be planning major developments. The development within the Asquith Corporation, will eventually involve three centres in Halifax—at Highroad Well, at the nearby works of Modern Foundries, Limited, and at the premises of George Swift & Sons, Limited, at Clare Mount. A new fitting shop is planned at Swift's and the preliminary work is in progress; extensions to Modern Foundries are already in hand. The Asquith Corporation also have in reserve land, now forming part of Sandhall allotments, which is adjacent to Modern Foundries. According to a spokesman of the Asquith Corporation, as reported in the *Yorkshire Post*, expansion in Halifax was planned several years ago but was delayed because of the labour situation.

Hartley's Malleable Fittings Company, Limited, are proposing to build new works at Copley, and they hope to have the first section in production at the end of this year.

Trade Weight Tolerances

The limits of error tolerated in weights used in trade are varied by the Weights and Measures (Amendment No. 6) Regulations 1958* which came into force on June 1. The main changes as compared with the tolerances at present laid down by the Weights and Measures Regulations 1907 are: (*a*) the amounts of error tolerated when a weight is inspected are the same in deficiency as in excess: hitherto the error allowed in deficiency has been half that allowed in excess; (*b*) the amounts of error have been altered, and (*c*) tolerances have been prescribed for metric carat weights.

These changes result in part from changes in the tolerances for local standards which are being made by the Weights and Measures (Local Standard Tolerances) (Amendment) Order 1958. This Order which amends an Order in Council of 1907 also came into force on June 1.

* S.I. 1958, No. 773; price 4d. (by post 6d.). Copies obtainable from H.M. Stationery Office, Kingsway, London, W.C.2, and branches.

Methods of Manufacturing Small Machine Components

By R. Schwalbe and P. Wiest

With the development of such casting processes as shell moulding, plaster moulding and so on it has been possible for small machine components, requiring both precision and surface quality, to be produced in the foundry. In the following abstract from a Paper presented at the European Investment Casters' Conference last year comparison is made between the various methods which can be used in this special field. The advantages and disadvantages of each process are described and an attempt is made to indicate the particular requirements which each is best able to meet.

The development of a number of casting processes such as shell moulding, plaster moulding, investment casting, etc., which, in respect of precision of scale and surface quality can meet considerably higher requirements than the usual casting technique, has done much to extend the use of cast small machine parts and has shifted the limits compared with other methods of production. It therefore appears expedient to compare some of the most important methods of production and to establish their advantages and disadvantages.

In the case of all new constructions or technical changes in the production of parts already being manufactured, it is important to establish carefully how the best qualities can be achieved most economically. In this connection the following questions should be answered: (1) What is expected of the part? (2) What material can meet the requirements of the desired shape with or without heat-treatment? (3) By means of which production method can this shape be most economically produced with the selected material? In many cases it will be impossible to reach a final decision as to shape, material and production method before specimens have been manufactured. Questions (1) and (2) are linked with the purpose for which the part concerned is required and cannot, therefore, be considered in this paper.

In the choice of a production method a number of factors are decisive. They may be summarized as follows:—Guided by the purpose for which the part is required, the designer designs it, establishes the dimensions and the properties in the necessary proportions, and then selects the materials in question. He is also supplied with details as to the precision and surface quality with which this part must be produced, how many pieces are required and what machinery is available for its production in the factory or whether this part is to be manufactured by another factory.

If to these requirements is added the very decisive factor of economy, it will be seen that the choice of a production method is dependent upon the following points: (1) the shape of the part; (2) its dimensions; (3) the properties in the necessary proportions; (4) the material required; (5) the required precision; (6) the desired surface-quality; (7) the number of like pieces required; (8) the available machinery, and (9) the all-over economy of the part.

Bearing these points in mind, some new casting methods will be compared:—(*a*) non-cutting shaping in solid form, (*b*) powder-metallurgy production and (*c*) metal-cutting shaping.

Casting Methods

When describing the casting methods, it is the Authors' intention to follow closely an article published in the September, 1954, issue of *Materials and Methods*. Six fundamental methods will be dealt with, namely (1) precision sand casting; (2) shell moulding; (3) plaster moulding; (4) permanent moulding; (5) die casting, and (6) investment casting.

It is not intended to describe the specialized casting-techniques which combine several advantages of those six, as sand and plaster, sand with various types of binders and others. Those six basic processes, however, allow a wide range of materials, shapes, sizes and characteristics for commercial production of close-tolerance castings. Figs. 1 and 2 show general characteristics of these casting types.

Precision Sand Casting

A sand casting is not normally regarded as a close-tolerance cast form, but several foundries have set up operations to cast in sand to a higher degree of accuracy than is normally expected with this process. The higher accuracy is attributable to foundry techniques and closer control over the variables rather than a change in process. At present, most of this type of sand casting is done in aluminium and magnesium alloys and the phosphor- and tin-bearing bronzes. The mechanical properties are approximately the same as those of conventional sand castings.

Shell Moulding

In the shell-moulding process, a mixture of sand and phenolic resin is baked around a pattern, generally made of aluminium, iron or bronze, in a mould-making machine. The resultant shells are assembled by glueing or bolting, and in some cases the shell is packed in a flask with backing material before pouring. The metal is melted and poured, and after solidification the shell is broken away from the casting. With the use of baked-sand cores or shell-moulded cores, quite intricate and

Manufacturing Small Components

substantial coring is possible. The shell-mould process can handle any alloy that can be cast in sand. Mechanical properties of shell-moulded castings are comparable to, or better than, those of sand castings.

Plaster Mould

This process uses for moulding a plaster material, an aqueous mixture of gypsum strengtheners and setting agents. It is cast in a flask around matched metal patternplates. When the plaster has set, the mould is removed from the pattern and baked to remove moisture and increase the permeability of the mould to air and gases. The mould is then assembled, with whatever cores are necessary, and the metal poured. The mould is expendable and is broken away from the casting after solidification and cooling of the metal. Because of the temperature limitations of the mould material, this method is restricted to the casting of alloys with a melting point of 1,093 deg. C. or lower.

These include aluminium, magnesium and some copper-base alloys, such as yellow brass, silicon-bronze, aluminium-bronze and manganese-bronze. The mechanical properties of plaster-mould castings are generally lower than those of permanent-mould castings; they can, however, by good design practice and proper casting techniques be approached to those of sand castings.

Permanent Mould

In this casting method, a metal mould of two or more parts is made from a wooden pattern. The mould material is usually a quality-controlled cast-iron. Where welding is necessary, the mould may be made of nickel-chromium steels. The mould is assembled, either on fringes or a straight draw, along with the coring necessary. Metal cores are used wherever possible and baked sand cores are used where retraction of metal cores is impossible. In this latter case, the tolerances and surface-finish obtainable in the sand-core areas of the castings are limited to those of sand casting. For complex parts, it has been found that a combination of iron, sand and plaster can most effectively produce the desired accuracy of fine detail.

Due to the relatively low temperature characteristics of the mould material, the process is limited to the lower melting-point alloys. Aluminium alloys are the most commonly cast, but copper-base alloys, magnesium and, more recently, grey iron are also cast by this method. The mechanical properties are relatively high because of the chilling effect brought about by the high thermal-conductivity of the mould material. This results in metal of fine-grained, dense structure.

TABLE 1.—*General Characteristics of Close-tolerance Castings.*

Type of casting.	Choice of materials.[1*]	Tolerances, in. per in.		Size range.	Average size of competitive castings, lb.	Minimum section thickness, in.	As-cast finish obtainable in limited areas (r.m.s.† units)
		Normal.	Possible on 1-in. dimension.				
Precision sand casting	(4)—Al, Mg and bronze alloys. Use of ferrous uncertain as to dimensional accuracy	± 0.005	± 0.003	Maximum size not known. Present production runs from under 1 lb. to parts 6 ft. in length	1–4	0.050	75–80
Shell moulding ..	(1)—Any castable alloys, though mostly ferrous being cast	± 0.005 ± 0.010 across parting line	± 0.003	½ to 800 lb.	20–30	0.070	60
Plaster mould ..	(5)—Al, Mg and some Cu-base alloys. (Melting point below around 1,093 deg. C.)	± 0.005 ± 0.010 across parting line	± 0.005	Under 1 oz. to over 100 lb.	3 to 5	0.040–0.060	50
Permanent mould	(3)—Al, Mg and Cu-base	0.015 in. overall on small dimensions	± 0.005	1 oz. to 600 lb.	1 to 10	0.090	100–125
Die casting ..	(5)—Al, Mg, Zn, some Cu-base alloys, tin and lead	± 0.005 ± 0.010 across parting line	± 0.002-Zn ± 0.003-Al	Under 1 oz. to 75 lb. in Al. Under 1 oz. to 200 lb. in Zn	½ to 1	0.050	50
Investment ..	(2)—Any castable alloy	± 0.005	± 0.003	Under 1 oz. to 25 lb. in wax or plastic and over 100 lb. in frozen mercury	Up to 1	0.030	60 wax and plastic 40 mercury

* Numbers represent relative range of selection of materials, e.g. (1) = widest choice, (2) = narrower choice, etc. † Root mean square.

Die Casting

This method involves the forcing of molten metal into a steel die set under pressures which range anywhere from 1.6 to 11.1 tons per sq. in. The degree of pressure will vary with the injection method and the alloy used. After solidification, the die is opened and the die-casting ejected. The two commonly used types of die-casting machines are the "plunger" and the "cold-chamber." The plunger machine is used mainly for zinc and other low-melting-point alloys and the cold-chamber machine primarily for the higher-melting-point alloys.

Due to the temperature limitations imposed by the use of steel as die material and the rapid mechanical injection of the molten metal, the choice of alloys which can be used in this process is limited to those with a low melting point. Maximum fluidity is also desirable to speed the filling out of fine detail and thinner sections.

The materials most widely die cast are the zinc alloys, followed by aluminium, magnesium, copper, lead and tin. These materials offer a rather wide range of selection as far as mechanical and physical properties are concerned. In die casting, as in permanent-mould casting, an advantage is derived from the high thermal conductivity of the steel used in the die. Whilst die castings are subject to varying degrees of porosity, proper engineering of the casting and the die may confine it to areas of the part where it is not critical.

If the average dimensions of the parts produced by the various methods are compared, the order of the methods—depending on the size of the part—is as follows: Investment casting, die casting, precision sand casting, permanent moulding, plaster moulding, and shell moulding.

The individual ranges of application overlap or even run parallel. For very small parts, only investment casting can be considered. Furthermore, the smallest thicknesses that can be produced according to method and casting material must also be considered. In regard to precision, the data for the various methods and casting materials varies greatly, but in general it can be said that with good co-operation with the foundry the tolerances quoted in Table 1 can be achieved, if not even exceeded. The most exact methods are investment casting and die casting; these are followed by plaster moulding and shell moulding.

If the various methods are judged according to the achievable surface-quality, investment casting and die casting are equally good, whereas plaster moulding and shell moulding are not so good and precision sand casting and permanent moulding are at the bottom of the list. Parts produced by the first three methods and consequently with a good surface can frequently be fitted without any, or with only slight, machining. The worse the surface quality is, the more finishing is required and the more expensive it becomes.

The economics of producing a part depend to a great extent on the production quantity and speed. Each of the processes discussed here can utilize multiple-cavity dies or moulds. When these are used, the rate at which a mould or die is filled must be multiplied by the number of cavities to determine the actual rate of production of castings. The number of cavities per mould or die will depend on the size and shape of the part. This is one of the reasons that these casting methods lend themselves well to the production of small parts.

In precision sand casting, small numbers of less than 50 pieces can be economical, but this is not the case where shell moulding and investment casting are concerned. For the production of form masks, metal patternplates are necessary, and for the wax or plastic patterns of investment casting, steel or soft metal dies. The minimum number of pieces for these methods varies considerably and lies between 50 and several thousands. Generally speaking, it can be said that whether the number of pieces turned out will make the production economical must depend on whether the costs, distributed over the number of pieces, are still bearable. In the case of permanent moulding and die casting, the figure is around 3,000 to 10,000 as the steel or cast-iron moulds required are generally very expensive.

However, not only the factors mentioned (all of which concern the actual part) are decisive for the choice of a method of production; the available machinery is also of importance. If the firm has its own foundry, it will, of course try to produce the parts there and only employ another firm if production of a certain part in its own factory would be very much more costly. If the firm has no foundry and not the necessary machinery to produce the part, matters are simpler and the choice of a method can be made according to the factors dealt with already in co-operation with the foundry.

TABLE 2.—*Cost and Time Factors in Production of Close-tolerance Castings.*

Type of casting.	Cost factors.				Time (from design to production).
	Labour.	Equipment (dies, patterns, and/or machines).	Casting materials.	Typical rate of production pouring.†	
Precision sand casting	Medium high	Low	High	300 per mo.	4-6 wks.
Shell moulding	Low	Medium high	Wide range	60 per hr.	4-6 wks.
Plaster mould	Medium high	Low	High	4-5 per hr.	4-6 wks.
Permanent mould	Medium	High	High, non-ferrous, Low, grey iron	30 per hr.	6-12 wks.
Die casting	Low	High	High	75-150 in Al, Mg, Cu-base 300-350 in Zn	8-14 wks.
Investment	High	Varies with quality of pattern die	Wide range	Generally low. Higher with plastic pattern	4-6 wks.

† These figures are general for one set of equipment. Actual rate of casting production would depend on the number of cavities per mould.

Non-cutting Shaping in Solid Form

The shaping of small parts in solid form can be done by means of cold or hot shaping. Table 3 gives an indication. The various processes of cold forming, *i.e.*, deflecting, deep drawing, flow pressing or stamping are mostly based on a basic process such as bending, twisting, drawing, upsetting, pressing or shearing. Hot shaping is done practically only by means of dies whereby the forming strength can be applied by a hammer or by a press.

Cold shaping is excellent for those small parts which are, on the one hand, punched bent, drawn or pressed out of sheet metal, and, on the other hand, upset or pressed out of cut rods. The shape of these parts generally varies from that of the castings. In the case of hot-shaped parts there is, on the other hand, a certain similarity with simple castings only that hot shaping is, in the rarest of cases, more favourable as regarding forming possibilities.

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Concerning the size of the parts, it can be said that all sizes (even the smallest) can be produced by cold shaping, whereas for hot shaping, the parts must be at least of medium size.

Both methods of production can be applied for all materials than can be plastically formed; for cold forming, however, the materials must have certain minimum forming-properties and these vary according to the shape of the part. The achievable properties, without subsequent heat-treatment, are after cold-forming dependent on the materials and forming degree and, after hot forming only on the material. They are generally superior to those of casting materials on account of their denser grain structure.

The precision of the produced parts is comparatively good, *i.e.*, in flow pressing tolerances of ± 0.1 mm. can generally be achieved, and in stamping also minimum $\pm$ 0.1 mm. The results of hot forming are not quite as good. In this case, a scaling of the parts and the abrasion of the dies must be reckoned with. The tolerance range is about ± 0.2 to 0.3 mm. and can be reduced in special cases, *i.e.*, turbine blades, to $\pm$ 0.02 mm., at the expense, however, of the dies.

The surface quality is medium to very good, depending on the method of production, the material and the degree of forming. The decisive factor is whether it will prove economical for nearly every part can be manufactured with a good to very good surface if the costs are increased. Hot shaping is not quite so favourable. The number of pieces that must necessarily be produced to render the output economical varies greatly according to the method. For stamping, other figures are necessary according to the shape of the parts, than for flow pressing, deep drawing or deflecting. A decisive factor is the cost of the tools which again depends greatly on the shape of the part. The same applies where hot shaping is concerned.

In the choice of the method the available machinery plays a great part. If the factory has its own presses, the choice is facilitated because in that case only some of the essential tools have to be produced. But if the factory has no suitable machinery all the other production possibilities must be considered when selecting the method of production. The quality and economical production of the part should, however, always be decisive.

Powder metallurgy

In this production method the parts are not produced by melting and casting of the compact metals but by reaction of metal powders in solid form, and so, if necessary, small quantities in liquid phase are occasionally added.

In general the process passes through the following stages: (1) conversion to powder of the basic metals or alloys or the compounds containing these metals; (2) production of compacts out of these metal powders or their compounds by means of compressing, *i.e.*, pressing in dies; (3) conversion of these compacts to the desired state of grain structure by heat-treatment in protective gas or vacuum with a sufficiently high temperature (sintering).

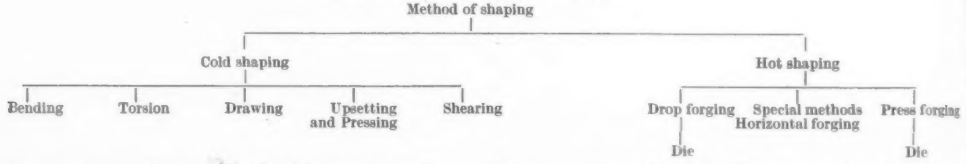
The sinter technique is at present being applied not only in the production of high-melting metals and alloys, sintered hard metals and metallic bodies with a certain porosity, *i.e.* porous self-lubricating bearings, but also in the mass production of small and medium parts for the manufacture of machinery and apparatus.

On a larger scale sintered parts are being produced on iron or copper bases; here, to a certain degree, the properties of the corresponding molten alloys can be achieved. However, the choice of alloy is limited since only those alloy elements can be considered that have adequate diffusion capacity in solid form. In any case, the achievable mechanical properties are inferior to those of melted materials. The moulding of sintered parts is governed by the laws of the pressure technique. Cross-cut differences parallel to the direction of pressure call for complicated tools; undercuts are generally not possible.

The size of the parts is dependent on the press and sinter equipment available. Fundamentally, however, the order of size of the small parts considered here lies within the range of powder metallurgy. The achievable precision lies in the direction of pressure around $\pm$ 0.1 to 0.2 mm. and vertical to the direction of pressure around $\pm$ 0.02 mm. The precision can be improved by calibration of the parts.

To render the method economical 5,000 pieces must be produced, as the cost of the tools is generally very high. Where, however, conditions are favourable for the application of the powder-metallurgy method, it proves especially economical and can in some cases even compete with the metal-cutting shaping.

TABLE 3.—*Non-cutting Shaping of Small Parts.*



Shaping by Metal-cutting

This method can, it is true, be employed for all parts but not for all materials. A decisive factor in the choice of this method is, however, not so much the shape and size of the part, the essential properties, precision and surface quality, but rather the material to be used, the machinery available and the question of economy. Where the firm has a plant for the mechanical process, *i.e.*

for turning, drilling, milling, cutting off, threading and grinding, and where large numbers of parts are to be produced, it only rarely occurs that there is a more favourable method of production. It is often possible very economically to produce complicated parts by fusion, welding or brazing of simple, machine-made parts. For this purpose, protection-gas continuous furnaces are used. It is only necessary in brazing to apply the copper solder to the parts that are to be fused. If the air gap is correctly selected, the parts that have to be joined fuse when passing through the furnace. Decisive factors to make the process economical are correct designing, right material and available machinery. Precision and surface quality of the parts are fair without any finishing being necessary. If the grain-coarseness caused during the process of fusion is adverse, this can be overcome by normalization, but any distortion which may arise must be taken into consideration.

Conclusion

In summarizing, the following can be said:—(1) The casting methods known today give the designer a wide choice in respect of precision. (2) Where the cast part is concerned, the designer has great liberty in the shaping and, today, also in the use of the various materials. The strength value is, however, linked with the properties of the molten metal. (3) Shaping in the non-cutting and metal cutting processes is greatly limited by the method; the direction of travel of the press determines the shape and the drawing capacity of the dimensions. In the case of the metal-cutting method, the part becomes economical if it can be produced entirely in one clamping; re-clamping increases the cost. (4) The fusing of several individual parts again gives the designer more liberty, but after the part has been assembled, there must be a suitable bearing to pass through the furnace so that the part retains its shape. In fuse-temperatures the strength of steel is low. (5) The same applies for sinter-parts as for drawn parts. The parts must be capable of shaping by pressure. (6) There is no rule as to the method which is most economical. What is important besides the skill of the designer and the number of parts to be produced, is his knowledge of the various methods of production, of the materials and, finally, the machinery, equipment and special appliances at his disposal at the factory.

Shaw Processes Development

Shaw Processes, Limited, have recently concluded licensing agreements with the Vulcan Foundries of Haifa, Israel, providing for the establishment of a demonstration and training foundry there which will deal with licensees not only in Israel but in Turkey and Greece. Mr. Clifford Shaw earlier this year visited the Israel industries which he toured on his way to South Africa where he took the opportunity of visiting his firm's licensees near Johannesburg.

The company also announce that they have negotiated through their associated company, the Shaw Process Development Corporation of Port Washington, Long Island, upwards of 35 licences in the United States and Canada. Since the demonstration and training pilot plant was established in Long Island late in 1956, this progress must be regarded as gratifying, having taken place almost entirely in the space of one year.

FIG. 1.—*Section of the US pilot plant operated by Shaw Process Development Corporation.*

Italian Foundrymen's Association

A series of bulletins has been issued by *Campfond* and *Assofond*, two associations covering the business and technical requirements of the Italian foundry industry. Each one is punched for filing and carries in the top right-hand corner the classification of the subject covered, such as malleable iron, cupola, materials handling, organization and general. Under the first heading there is a paper by Mr. Bruzzi entitled "Modernization of the Melting Plant in a Blackheart Malleable Iron Foundry." Though the writer is not too familiar with the Italian language, it would appear that this paper records in some detail the changes made in the melting plant (a large pulverized fuel-fired reverberatory and three rotary furnaces with additions from time to time), to meet the requirements of mechanized moulding.

A paper on cupola practice, by Mr. Oltrasi and Mr. Giunchedi, deals with a hot-blast plant wherein the recuperators are heated with methane gas. Other papers cover a unified system of time-study developed by *Assofond;* rationalization of mechanized foundry plant by Mr. G. Somigli; Italian experience of the mechanization of foundry plant by Mr. L. Oltrasi; internal transport methods in the foundry by Mr. E. Doriguzzi; the evolution of technique in the aluminium foundry —gravity and pressure-die-castings—by Mr. M. Maschera; quality control in the non-ferrous foundry, by Professor E. Hugony; some applications of quality statistical control in the microfusion process, by Mr. G. Postanga, and a second quality statistical control in the foundry by Mr. R. Sacerdote.

The papers are well presented and the associated filing system will ensure the future use of those deemed to be of value by the recipient.

ECSC Steel and Pig-iron Output

An increase of 2.7 per cent. in the output of crude steel (ingots and castings) in the first four months of the year, compared with the corresponding period in 1957, for the six countries of the European Coal and Steel Community is reported by the High Authority's statistical division. The figures, which are provisional, show that output from January 1 to April 30 reached 20,223,000 *tonnes,* compared with 19,689,000 *tonnes* last year.

The outstanding contribution to the rise in crude steel output was made by France, which produced an additional 468,000 *tonnes,* representing a 10.1 per cent. increase. For the month of April, output was slightly lower, at 4,832,000 *tonnes,* than the March figure of 5,196,000 *tonnes,* but there was an improvement of 114,000 *tonnes* on the total of 4,718,000 *tonnes* for April, 1957.

Production of pig-iron and ferro-alloys in April amounted to 3,615,000 *tonnes,* compared with 3,887,000 *tonnes* in March, but it was almost exactly the same as last year's total of 3,618,000 *tonnes.* Here, too, there was an increase (1.8 per cent.) on the four-monthly total, compared with 1957. So far this year production of pig-iron and ferro-alloys reached 14,961,000 *tonnes.* In the corresponding period of 1957 the total was 14,703,000 *tonnes.*

BOWDEN HOLDINGS, LIMITED—Mr. H. H. S. Hillier has been appointed a director of the company and of its subsidiary, Bowden (Engineers), Limited. Mr. W. A. Melsom has resigned from the boards.

Meehanite in South Africa

The eighteenth annual conference of the Southern African Meehanite Development Association was held in Johannesburg on April 9 and 10. At the foundry session, interest centred around local operation of cupolas under basic slags. A colour slide was shown, illustrating that, under certain conditions, it is possible to obtain a white "falling" slag of over 55 per cent. CaO content, similar to that obtained with electric steel-furnace slag manipulation. Of 30 Meehanite-designed cupolas in Southern Africa, 16 are now operating with basic linings. Attention was also focussed at this session on production of castings to precise dimensions through the use of the CO_2 Process and other methods. At the management session, a committee reported on new uses which have been developed for Meehanite castings, many arising from the introduction of basic-melted metal.

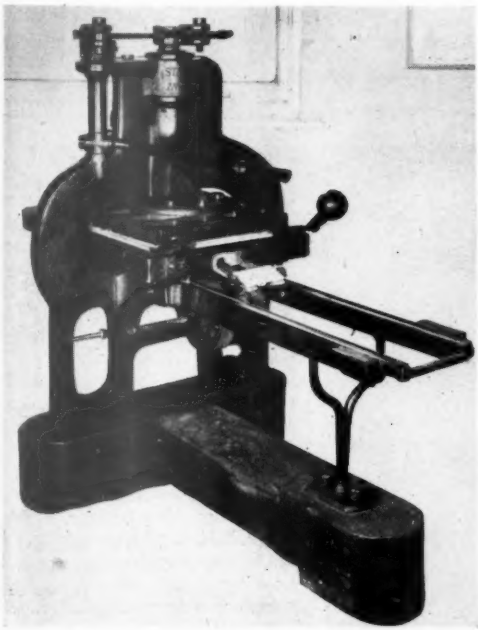
Monument to the First Gold Digger at Kalgoorlie

The bronze figure, shown in the illustration below, was erected by public subscription in 1929, *during the centenary of Western Australia celebrations. The statue incorporates a water-bag fountain which is symbolical of the spirit of the pioneer prospectors, who were always ready to share their last drop of water with their fellows. The sculptor was John Macleod, who was engaged as an art instructor under the Education Department of Western Australia for some years and who then went into private practice.*

Founding and the Printing Industry

The ironfounding industry receives few garlands yet in truth it deserves many if its part in industrial development were properly appreciated. This is apparent for instance in the development of printing. All have seen prints of Caxton—who introduced printing to this country—printing on sheet and receiving the approbation of his King and doubtless his country—but few realize the founder's contribution to the making of iron printing presses. Caxton used a wooden-frame printing press; in those days, few could either read or write and in consequence, slow as the process of printing then was, it sufficed the needs of the times and, surprisingly, some original editions of the world's classics in literature to say nothing of bibles and news-sheets were printed by these means. (In fact, in the possession of the Science Museum is one of these old wooden printing presses—presented by Spottiswoode Ballantyne & Company, Limited—upon which were printed the early editions of Sir Walter Scott's Waverley Novels.) The wooden was succeeded by the first all-iron printing press, invented by Charles, the third Earl Stanhope (somewhere about 1798). Surely, it is no overstatement to see in this effort of the ironfounder the birthplace of modern civilization? In some respects, the speed of printing was not obviously enhanced and yet it was, in fact, because the massive iron frame enabled a much larger sheet to be printed and—in printers' parlance—a much heavier forme or mass of type.

FIG. 1.—*Stanhope iron printing press recently presented to the Birmingham City Museum and Art Gallery by Horton-Stephens (Printers), Limited.*



After much searching, one of these Stanhope presses (Fig. 1) is now on view in the City of Birmingham's Museum of Science and Industry. These presses became very popular—somewhat surprising to us of the present day—as was shown when the present (seventh) Earl Stanhope unveiled a memorial plaque to his famous ancestor. He said: "When *The Times*—the world's most famous daily paper—was first produced by machines, 120 of these presses were displaced." Readers of the JOURNAL may remember that an illustration of a Columbia* printing press was published some time ago. This was one of the first possessions of the Museum, though the Birmingham Science and Industry illustration appeared before the museum was actually opened or received its present name officially. The same museum in addition, now possesses an "Albion" press—this is also all of cast iron but of English origin. Thus, by recording Earl Stanhope's activities and illustrating the noble earl's second design, it is shown that the ironfounder really entered into and made possible the early printing industry. Nowadays, one marvels when meeting a person who cannot read—and newspapers are produced upon all-iron machines weighing many tons and turning out thousands, at the speed of an express train, completely printed, folded and counted. Caxton's efforts came under the heading of letterpress printing which even to-day totals the bulk of reading matter whether news or otherwise. Yet there are quite a number of other kinds of printing, all requiring machines or presses reflecting in great or small degree the founder's skill.

Subsequent Developments

The proprietors of *The Times*, then a family named Walter, were always anxious to progress in both the art and speed of printing. After many other efforts, members of their staff (Applegarth and Cowper) designed "Perfect Printing Machines." These were, in the main, produced by Thos. Middleton & Sons at Southwark and Dryden and Foord's, at Lambeth. There is little doubt that the former firm was so engaged, because their name appears in the catalogue of the 1851 Great Exhibition, with beam-motion steam engineering as one of their specialities. This period might be described as the heyday of iron castings and it might be said with truth that the greatest attraction in any exhibition was the size and weight of the castings on show, more especially if they had any claim to being artistic.

It is reported that *The Times* was attracted by a printing-machine invention of Robert Hoe of New York and as it was decided that it was a real disadvantage to have to turn to New York for supplies, the firm of R. Hoe & Company, Limited, was founded for the production of machines and was for many years renowned in Borough Road,

* "Historical Printing Press," FOUNDRY TRADE JOURNAL, March 1, 1951.

Founding and the Printing Industry

Southwark. As a matter of interest the firm expanded until it came to occupy the very blacking factory at which the young Charles Dickens worked. Already a number of engineering firms had established themselves close to the Thames bank, which was then the great centre for shipbuilding and as the Stanhope press provided a nucleus of wealth and wages at that time, it is small wonder that many of these engineering firms thought of catering for the printing trade. The result was that foundries producing printing machines cluttered in and around the City of London, more particularly in Southwark, Lambeth, Clerkenwell and Finsbury. D. Napier & Sons, formerly of Lambeth and now with works at Acton and elsewhere, had a substantial share in this business.† An old press manufactured by Napier's is in possession of the Science Museum at South Kensington.

Other foundries established in this area included J. Stone & Company which was started in 1831 at Deptford Green, eventually reaching Arklow Road, Deptford, where they extended both iron and bronze foundries—in conjunction with other works on Thames bank at Charlton. Readers probably know that Johnson Matthey & Company had their works, until recent years, in Hatton Garden, and later moved out of town. A number of other foundries, essential to the newspaper industry, were set up in and around Fleet Street. In this brief historical review, Dewrance's with their brass and alloy foundry in Great Dover Street, established for producing steam fittings, must not be overlooked (although foundrywork is no longer carried on at this works). Waygood-Otis, Limited (formerly R. Waygood & Company, Limited), lift and elevator manufacturers, of Falmouth Road, also had an iron foundry near at hand.

† Among the pioneer activities of this company was "Anglo-French cylinder machines" evidently an early model of the "Two-rev." American machines which were later imported in such numbers.

Wine Tasting in a Foundry

Scotland is rapidly gaining its old reputation as a wine-loving country. At one time every man in the street knew what was meant by a stoup of claret. According to the experts, the consumption of wine nowadays is no longer confined to what used to be known as the leisured and professional classes. Greater equality of incomes, aided by the recent Budget reduction of duty, has placed wine within the reach of thousands of potential new customers. Holding the view that the average Scottish industrial worker is just as good a judge of wine as anybody else, John Harvey & Sons, Limited, arranged a sherry tasting in an iron foundry—probably the first of its kind in the world. In association with Lane & Girvan, Limited, Bonnybridge, the "party" was held in their foundry on May 30.

Clean Air Conference

The first international conference on Clean Air is to be held in London next year. The National Society for Clean Air, until recently known as the National Smoke Abatement Society, is planning to celebrate not only this first international venture, but also the diamond jubilee of the British movement which started in 1899 with the Coal Smoke Abatement Society.

In addition to some 750 British delegates who are expected to attend, there will probably be many from overseas. In Russia the Government is supporting a wide programme of research and the US has two voluntary associations similar to the NSCA. South Africa has a smoke problem, particularly in Durban, and India is afflicted with the smoke from factories in Bombay and Calcutta.

Presentation to Mr. N. P. Newman, J.P.

In the accompanying photograph is shown the silver salver presented to Mr. N. P. Newman, late chairman of the Council of Ironfoundry Associations, on his retirement from that body. The salver bears the signatures of past and present members of the CFA Council, and the presentation was made at a dinner party, held on board the Wellington, given in his honour. Mr. M. J. Glenny, the new CFA chairman, was the host. (Notes on the function and a list of the principal guests were given in last week's JOURNAL.)

National and Midland Ironfounders' Association

Chairman's Annual Report

At the annual general meeting of the National and Midland Ironfounders' Association, recently held in Birmingham, the chairman (Mr. J. W. Gardom), in the course of his remarks, referred to price-cutting. He said the last 12 months had not been an easy period for the foundry industry and had caused the Association some concern. It had, however, maintained very close liaison with the Council of Ironfoundry Associations and appreciated the help and guidance which had been given. The difficult trading conditions were encouraging some unwise founders to quote prices for castings which were uneconomic. In some instances reported, the prices would appear to be below cost. The Association deprecated this practice and urged all its members to ascertain their true costs before quoting, and to realize that price cutting was not advantageous in the long run either to the foundry concerned or the industry.

A suggestion had been put forward that, if the appropriate facts were reported to the secretary, in confidence, it would be possible for him to approach members, draw their attention to the consequences of their action and enquire whether they had carefully checked their costs before quoting. Such a scheme could only be introduced with the consent of members and he hoped this would be actively discussed.

Foundry Regulations

Many foundries were confronted with problems arising out of the Foundry Regulations, Clean Air Act, the Thermal Insulation of Buildings Act, and the like, during the year. The need to adhere to the Foundry Regulations in order to observe a foundry's obligations under the law and also to dispel the impression that iron foundries were unsuitable work places is as urgent as ever. The Association would continue to give what help and advice it could in this connection.

The Clean Air Act was causing many foundries great uneasiness. The industry as a whole would prefer to be under the supervision of the Alkali Inspectorate in respect of its provisions. The Association was particularly concerned with the problem of fitting grit arrestors and to ensure that the requirements of local authorities were such as are "reasonably practicable" for the small founder. It was assisting one of the members in the City of Birmingham with regard to this problem and it, and the CFA, regarded this as a test case which required the most careful help and consideration. If any member had any difficulty whatsoever, he should make contact with the secretary immediately.

Publicity

Speaking of publicity, the chairman said he presumed that members had seen the Birmingham newspaper, published on May 8, in which an advertisement appeared drawing the attention of ironfounders to the activities of the Association and urging them to join it. Articles also appeared under the name of the president, the chairman and of Mr. Hird of Rudge Littley, Limited.

Future Policy

The executive committee had given careful consideration to the question of policy, particularly having regard to the need to recruit new members and also to provide existing members with a better service. The following action was proposed:

New Members: A recruiting pamphlet had been prepared by the publicity committee designed to show the advantages of joining the Association and encouraging ironfounders to do so. A copy was available for anyone who was interested and members were asked to take one and try to persuade any of their acquaintances who were not members to join.

Propaganda: Consideration was being given to the preparation of a brochure which will be issued free to members for use in their sales department; this would depict the wide range of castings produced by the members of the NMIA. The intention was to encourage customers to obtain their casting requirements of all kinds from the members of the Association. This matter was in the hands of the publicity committee and the executive.

Quarterly Meetings

The committee was of the opinion that a series of quarterly meetings should be held, at which topics of general interest to founders could be discussed. The first of such meetings was held at Wolverhampton, in March, when the subject of "Costing and Estimating" was the subject of a talk by Mr. Harrison. Arrangements were in hand for a further meeting when the topic of the Clean Air Act would be the subject of debate. Members were asked to support these functions not only on account of the technical interest but also because of the useful contacts which would be made with other members of the Association.

General Matters

The Association would continue to express members' views on all current commercial matters such as materials, transport, insurance and the like. Mr. Gardom recommended that members take advantage of the legal advice which was available to them should they require help in general foundry matters and he hoped they would avail themselves of this service if it was required.

Social Function

It had been suggested that it would be to the advantage of members if the Association arranged a social function. Observations on this subject

NMIA Association

would help the executive to decide what action to take (if any) and where.

Committee

Finally, he thanked the executive for their support during the year and for the tasks which they had accomplished. Without the continued active and voluntary interest in the affairs of the Association such as the elected representatives had shown, it would be impossible to represent adequately the many varied interests of ironfounders in the Association.

He would be satisfied so long as the NMIA was a strong and influential body, safeguarding the true interests of ironfounders and he was sure that this duty could be carried out so long as everybody pulled together for the good of the industry.

Election of Officers

At the meeting the following officers were appointed:—Mr. J. W. Gardom, as president Mr. W. H. Thursfield, J.P., as chairman; Mr. W. James, as deputy chairman; Mr. W. H. Thursfield, Mr. W. James and the secretary as trustees; Mr. L. H. Cleaver, J.P., F.C.A., as secretary, and as auditors, Camp, Ravenscroft & Company. In the ballot for the seven vacant places on the executive committee for 1958 the following were elected: Mr. H. Darville (Rudge Littley, Limited); Mr. M. M. Hallett (Chamberlin & Hill, Limited); Mr. E. Hunter (Court Works, Limited); Mr. A. Jones (Izons & Company, Limited); Mr. E. F. Kendrick (Highway Ironfounders (West Bromwich) Limited); Mr. G. C. Scales (John Hill & Sons (Ironfounders), Limited); and Mr. W. F. Trafford (Arthur Shaw & Company, Limited).

INVESTIGATIONS into the full consequences of a change-over to the metric system in Britain are to be carried out by a study group, under the chairmanship of Sir Hugh Beaver, which has been set up by the British Association for the Advancement of Science.

This rough draft would then be checked and re-written in a more presentable form. At this stage, if it had not been already done, a colleague, who had more experience of this kind of work, could be approached with a view to his reading over the initial effort and making comments on the work.

When the paper has been finally re-written a great deal of satisfaction will be felt as a result of the creative work involved to say nothing of what will have been learnt. If some time later the article appears in print, all the effort will be rewarded, not only financially, but by increased status amongst one's fellows arising from the feeling that a contribution has been made to the well-being of the industry which provides such an interesting livelihood.

* The Author is lecturer in foundrywork and patternmaking at the School of Engineering, Burnbank, Lanarkshire.

Editor's Note.—Contributions to the JOURNAL from practical men are always welcomed and if accepted are paid for at current rates.

Why Not More Articles from the Craftsmen ?

*By C. B. Fearnside**

Among the craftsmen in foundries and patternshops is a vast store of information and know-how which, if only it could be published, would be of inestimable value to the industry. Perhaps one of the principal reasons why the man on the floor or bench does not turn out articles in such volume as his colleagues in other departments is due to lack of experience in writing. More confidence may be felt by such men if it were realized that the main thing is to have something to say, and that the ability to write grammatical English, use the right word, or spell correctly is not of paramount importance. Those other craftsmen, the sub-editors of the Press, can quite easily remedy any shortcomings in that direction.

Initial Preparation

The preparation of an article for publication, or a paper to be given as a lecture, resembles in some respects the building of a pattern or a large mould. An overall picture of what is intended must be kept clearly in mind throughout and, as the idea is being worked out, important details will become apparent and a note will be made of them. When practical work has been started a moulder or patternmaker knows from experience that it must proceed carefully and in a certain order, paying attention to detail and seeking guidance on any problems which may arise. Final independent checking and inspection is also an important part of the procedure, and this is all true of writing an account of procedures or methods.

Job Breakdown

Having the subject for an article in mind, one can begin the preparatory work by making brief notes of the main points. For example, assuming that it were intended to describe the production of a certain pattern or casting, the following headings might be made to cover the broad outline of the article:—

(*a*) The original type of pattern or method of making the casting.

(*b*) The difficulties or problems arising from the use of that method and the reasons for making subsequent modifications.

(*c*) The changes or modifications which were made and problems which arose.

(*d*) The means adopted to overcome these problems and the ultimate advantages which were achieved.

Under each of these headings further short notes could be made of all relevant details connected with the work. Consultation with colleagues in other departments would probably be necessary at this stage to ascertain facts and figures and collect any relevant information. Drawings and photographs would be made or obtained and incorporated in the work in order to illustrate certain points.

(*Concluded at foot of col.* 1)

1958 European Foundry Apprentice Competition

As previously reported in the JOURNAL, the European Foundry Apprentice Competition, which was held for the first time last year in Stuttgart, will this year take place in Paris. Full details of the competition were published in the April 24 issue of the JOURNAL, and from the entries received from foundries in all parts of Britain, the joint committee set up to organize British participation in the event, has selected 32 apprentices who will be taking preliminary examination at various centres in the UK on June 6. Those chosen as potential competitors to represent this country are listed below:—

Name.	Employer.	Additional training received at:
C. A. Collins	J. & E. Hall, Limited	Borough Polytechnic and National Foundry Craft Training Centre
N. J. Britnell	J. Samuel White & Company, Limited	Isle of Wight Technical College, Newport.
P. D. Bottomley	Blackstone & Company, Limited	Peterborough Technical Institute and National Foundry Craft Training Centre.
P. J. Blowers	Ransomes & Rapier, Limited	Ipswich Civic College and Mechanite Training Centre, Butterley.
D. A. Boxall	Sterling Metals, Limited	Coventry Technical College and National Foundry Craft Training Centre.
J. A. Littlewood	W. & T. Avery, Limited	Wednesbury County Technical College and National Foundry Craft Training Centre.
K. T. Cawser	F. H. Lloyd & Company, Limited	Wednesbury County Technical College.
R. Degville	F. H. Lloyd & Company, Limited	Wednesbury County Technical College.
J. W. Badland	F. H. Lloyd & Company, Limited	Wednesbury County Technical College.
B. H. Cook	Bayliss, Jones & Bayliss, Limited	National Foundry Craft Training Centre and Wolverhampton and Staffs College of Technology.
P. Calvert	Hepworth & Grandage, Limited	Bradford Institute of Technology.
E. C. Sykes	H. Downs & Sons (Huddersfield), Limited	Huddersfield Technical College and National Foundry Craft Training Centre.
A. M. Croft	Leyland Motors, Limited	Bolton Technical College.
B. Cockcroft	Cooper Brothers, Limited	Accrington College of Further Education.
M. Tobin	Metropolitan-Vickers Electrical Company, Limited	Spurley Hey Evening Centre, Gorton.
T. B. Lindley	English Steel Corporation, Limited	College of Commerce and Technology, Sheffield.
P. L. Warnes	English Steel Corporation, Limited	Rotherham Technical College.
H. P. Williams	Hadfields, Limited	College of Commerce and Technology, Sheffield.
A. Bacon	Hadfields, Limited	College of Commerce and Technology, Sheffield.
A. Walker	Renishaw Iron Company, Limited	Clowne Technical College, Chesterfield.
J. B. Harker	Hadfields, Limited	College of Commerce and Technology, Sheffield.
P. Humphries	Renishaw Iron Company, Limited	Clowne Technical College, Chesterfield.
D. Perkins	Stanton Ironworks Company, Limited	Ilkeston College of Further Education.
B. Hill	Stanton Ironworks Company, Limited	Ilkeston College of Further Education.
P. Hackett	Rolls-Royce, Limited	Derby and District College of Technology.
J. H. Lincoln	Head Wrightson & Company, Limited	Constantine Technical College, Middlesbrough.
M. R. Winterson	Newman Industries, Limited	Bristol College of Technology.
W. M. F. Pope	W. A. Baker & Company, Limited	Pontypool College of Further Education.
J. Deans	Harland & Wolff, Limited	David Dale College.
A. Whitfield	Distington Engineering Company, Limited	Workington College of Further Education.
M. Cowley	Distington Engineering Company, Limited	Workington College of Further Education.
W. Routledge	Distington Engineering Company, Limited	Workington College of Further Education.

Butterley Company's Distribution Unchanged

Amount of the reserve arising on the nationalization of the coal-mining interests of the Butterley Company, Limited, is now known and, states the chairman, Mr. M. F. M. Wright, the total which can be regarded as being available for distribution free of tax is £1,655,710. The proposed simplification of the profits tax structure raises questions as to the future policy of the company in regard to dividend distributions. This will be considered by the board and a statement made in due course.

The activities of the company were concentrated last year on engineering, development in the field of industrial gases, and the brickworks and building supplies business. Restriction of the civil engineering side had resulted in a loss greater by £73,739 than the provision of £310,000. In the reduction of farming activities the company had been seriously hampered by the programme of open-cast coal mining which threatened the company's property. The engineering works had a record year and demand for finished products continued at a high level.

Group net profit for 1957 is £7,597 (£78,728). The distribution is unchanged at 1s. per 2s. 6d. share.

Iron-ore Imports

Iron-ore imports in April, and the totals for the first four months of this year and last, are shown below.

From	Month ended April 30.	Four months ended April 30.	
	1958.	1957.	1958.
	Tons.	Tons.	Tons.
Sierra Leone	80,625	242,355	275,605
Canada	—	130,272	118,616
Other Commonwealth countries and Eire	1,835	7,532	1,835
Sweden	253,154	1,130,218	1,198,307
Norway	32,111	65,028	86,753
Western Germany	2,522	—	2,522
France	54,839	228,355	193,743
Portugal	15,600	37,866	52,544
Spain	78,364	348,046	244,205
Algeria	185,365	513,138	585,296
French West Africa	27,358	226,022	181,191
Tunisia	8,745	280,156	222,229
Northern Morocco	19,525	66,657	61,845
Southern Morocco	56,260	117,811	162,569
Liberia	10,370	152,084	96,778
Venezuela	158,041	418,363	613,451
Brazil	32,472	184,062	199,479
Other foreign countries	29,435	14,093	86,736
TOTAL	1,046,621	4,162,058	4,383,704

Iron Castings Production

Sectional Variations

The Joint Iron Council have issued the following detailed commentary on the Iron and Steel Board's announcement of iron castings production in the first quarter of 1958:

Total Output

The total output of iron castings in the first quarter of 1958 at 961,000 tons was the same as in the previous quarter and as in the first quarter of 1957. This correspondence between the figures of total output for the industry, however, has in itself little significance as the outputs of various sections of the industry have differed widely over these same periods.

Main Sections

Table 1 shows the output of iron castings in the first quarter, and compares this with output in the previous quarter and the first quarter of 1957:

TABLE 1.—*Output of Iron Castings by Sections*

Section (Grey and malleable iron castings).	Percentage change in output.		
	First quarter 1958.	Previous quarter.	First quarter 1957.
	Tons.		
Automobile (including tractors) ..	150.5	+3.7	+28.3
Engineering*	337.2	−0.4	− 2.9
Building and domestic	133.2	−8.8	−12.5
Pressure pipes† and fittings ..	141.1	+5.5	− 2.4
Ingot moulds‡	107.3	−2.5	− 2.5
Railway equipment	91.8	+3.5	+ 1.1
Total	961.1	−0.1	− 0.1

* Including machine tool, textile machinery, electrical, shipbuilding etc.
† Mainly gas and water.
‡ Mainly for the steel industry.

The continued high activity of the motor industry has been reflected in a strong demand for castings from this section, and output in the first quarter of the year reached an all time record exceeding the previous record quarterly figure by nearly 4 per cent. The rather poor trading conditions which have been experienced for some time by many other sections showed little sign of improvement in the first quarter. The engineering section, affected to some extent by the reduced demand for machinery and industrial plant, fell short of the production achieved either in the previous quarter or in the first quarter of 1957. The output for the building and domestic industries, after holding up reasonably well throughout 1957, began to feel the effects of the uncertain conditions developing in the building industry in the early months of 1958, and output for the first quarter was noticeably reduced below that of the previous quarter and below the first quarter of 1957. Ingot-mould output suffered a slight setback in the quarter. The output of pressure pipes rose above that of the previous quarter, but did not quite reach the output of the first quarter 1957. Production of railway equipment continued high and in excess of the output reached either in the previous quarter or in the first quarter of 1957.

Raw Materials

The ironfounding industry's consumption of its principal raw materials is shown in Table 2, and the production of iron castings, by district, is shown in Table 3.

TABLE 2.—*Pig-iron and Scrap Consumption by Foundries.*

—	Tons.	Percentage change.	
	First quarter 1958.	Previous quarter.	First quarter 1957.
Pig-iron (including refined iron) ..	548.9	−0.8	− 3.1
Scrap iron (about half is foundry circulating scrap)	722.4	+0.1	+ 3.7
Scrap steel	105.5	+1.2	+13.6
Coke	283.1	+5.8	+ 0.7

TABLE 3.—*Production of Iron Castings by District.*

District	Iron castings (tons).	
	First quarter.	First quarter.
	1957.	1958.
Northern	97,100	98,600
North West	108,010	100,190
Yorkshire	112,060	111,680
East Midlands	199,040	193,410
West Midlands	192,650	204,290
Eastern and Southern Counties	92,880	96,070
Scotland and Northern Ireland	99,220	92,870
Wales and Monmouthshire	61,030	64,040
Total	961,990	961,150

Drop in Machine-tool Orders and Deliveries

Further fall in machine-tool orders has been recorded for February, both orders and deliveries being down, compared with January and with February, 1957. New orders received during the month amounted to just under £5,300,000, compared with £6,600,000 in January, and deliveries dropped from £8,600,000 to £7,070,000. The greater drop was in deliveries to the home market.

In February the industry's order-book shortened a further £2,500,000 to £72,800,000—about nine months' production at normal output rates. Over the past 12 months the decline has been about 25 per cent. Orders outstanding, compared with 1957, are £54,400,000 (£72,300,000) for customers in the UK and £18,400,000 (£23,900,000) for export.

AT A RECENT MEETING of representatives of all the organizations who served on the Council of the first festival, it was decided unanimously to organize a second festival of "Films in the Service of Industry" to be held in Harrogate from April 21 to 24, 1959. Lord Godber has consented to preside.

Thames Foundry in Perspective

The picture on the facing page is reproduced from an artist's drawing of the new Thames Foundry of the Ford Motor Company, Limited, of Dagenham, which was described in extenso *in last week's issue of the* JOURNAL. *Drawn to relative scale, the picture—the result of several months' work by Mr. Leslie Carr who is well known for work of this type—gives the impression of the third dimensional unobtainable by any other means. Inset is shown the artist's impression of the control station for "punched-card" coresand mixing and distribution.*

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Personal

Mr. H. I. MATTHEY has been appointed a director of Johnson Matthey & Company, Limited.

Mr. G. S. McDONALD has been elected president of the Institution of Structural Engineers. He will take office in October.

Mr. G. P. FELSTEAD, director of the Sheffield Smelting Company, Limited, which he joined in 1934, has been admitted to the Freedom of the City of London.

Mr. A. J. L. MONCUR, registrar of the United Steel Companies, Limited, is to retire on June 30. He will be succeeded by Mr. E. DALES, at present assistant registrar.

Caterpillar Tractor Company, Limited, announces that Mr. G. P. ROBERTSON has been appointed manager of a new export division operating within the sales department.

Mr. J. RUSSELL HICKMOTT has been appointed London manager for Perkins C.M.E., Limited, of Derby, which will shortly be opening showrooms in London for the display of oil-fired domestic and industrial boilers.

Mr. M. A. HENSTOCK, assistant works manager of Derby Locomotive Works, has been appointed assistant supplies and contracts manager in the stores department, London Midland Region, British Railways, Euston.

Stanton Ironworks Company, Limited, has just supplied the Mayor of Ilkeston for the seventh time from its staff. He is Councillor CECIL HORRIDGE, a maintenance fitter, who was installed on Saturday, May 24.

The Council of Sheffield University has appointed Mr. J. M. WEST to the United Steel Companies' Research Fellowship in Metallurgy, and Dr. H. T. J. CLINTON and Mr. J. F. TILNEY-BASSETT to the ICI Research Fellowships.

After 50 years with Glenfield & Kennedy, Limited, valve-makers, founders and hydraulic engineers, of Kilmarnock (Ayrshire), Mr. HENRY GARDNER, managing director, has retired. He will remain on the board in a consultative capacity.

Dr. E. R. PATRICK, at present head of North Staffordshire Technical College's engineering department was, on May 23, appointed principal of the College. The appointment will take effect on October 1 when the present head, Dr. H. W. WEBB, retires.

Bonnington Castings, Limited, announce the appointment as works manager of Mr. J. BLACKBURN, recently of Lloyds (Burton), Limited, and formerly of Osborn Foundry and Engineering Company, Limited. Mr. Blackburn is to take up his duties on June 23.

Mr. J. H. HORLOCK, a lecturer in engineering at Cambridge University, has been appointed to the Harrison Chair of Mechanical Engineering at Liverpool University. Mr. Horlock was a former designer and development engineer with Rolls-Royce Limited, Derby.

Mr. J. HAMMOND has been appointed deputy chief engineer of Samuel Fox & Company, Limited, of Stocksbridge, near Sheffield, a subsidiary of the United Steel Companies, Limited. Mr. Hammond joined the company in 1945 to take charge of the engineering workshops and was appointed works engineer last year.

The Tyne Shipbuilders' Association has re-elected as chairman Mr. C. STEPHENSON, director and general manager of Hawthorn Leslie (Shipbuilders), Limited, Hebburn, and, as vice-chairman, Mr. P. DENHAM CHRISTIE, managing director of the Neptune Yard, Walker, of Swan, Hunter, & Wigham Richardson, Limited.

Mr. WILLIAM EDWARD PARTRIDGE, holder of the long service record with J. Brockhouse & Company, Limited, of West Bromwich, retired last Friday at the age of 81. He has been with the firm for 59 years. Last Friday week he was presented with a gold watch on behalf of the board, by Mr. J. L. Brockhouse, chairman and managing director.

Sir ERNEST FIELD retired on May 31 from the directorship of the Scottish Engineering Employers' Association, a post he has held since it was created in 1944. During his directorship he has done much to improve relationships between employers and employees. It was in 1909 that he went to the Clyde from Devon for two years' engineering experience—which extended to his retirement!

Sir ARCHIBALD FORBES has been elected to the boards of the Dunlop Rubber Company, Limited and the English Electric Company, Limited. Chairman of the Iron and Steel Board since 1946, Sir Archibald, who is 55, is also chairman of the Debenture Corporation and a director of Spillers and the Shell Transport and Trading Company. From 1951 to 1953 he was president of the Federation of British Industries.

Sir HENRY SPURRIER, chairman and managing director of Leyland Motors, Limited, and Mr. A. E. PEARCE, a director of Qualcast, Limited, have been appointed part-time members of the Iron and Steel Board. In view of his appointment, Sir Henry has relinquished his position as chairman of Scammell Lorries, Limited, although he will remain on the board. Mr. WALTER WEST, vice-chairman and deputy managing director of Leyland Motors, has been appointed chairman of Scammell Lorries.

Mr. ERIC H. MEES, the principal of the firm of Eric H. Mees & Company, Limited, engineers and ironfounders of Amblecote, Stourbridge, has been elected chairman of the Amblecote Urban District Council for the third time. Mr. Mees, who established his own ironfoundry firm in 1946, is a member of the Brierley Hill Traders and Manufacturers Association, the Staffordshire Iron and Steel Institute and the Institute of British Foundrymen. His father was chairman of the same Council in 1928.

Mr. ROBERT ASQUITH, chairman and joint managing director of William Asquith, Limited, machine-tool manufacturers, of Halifax (Yorks), and chairman of a number of other well-known machine-tool companies, and Mr. FRANCIS FIELDING, deputy chairman of Fielding & Platt, Limited, makers of hydraulic presses, machinery, pumps, etc., of Gloucester, and deputy chairman and managing director of the Heenan Group, Limited, and other companies, have arrived in Moscow at the invitation of the Soviet Government. They are visiting machine-tool factories and research institutes in Moscow, Leningrad, and Odessa.

Mr. J. F. CHAMBERS has been appointed director in charge of production and Mr. D. W. EVERETT sales director of High Wycombe Foundry Company, Limited, high-duty ironfounders, and of Salt Hill Foundry, Limited, non-ferrous founders, both companies in High Wycombe, Buckinghamshire. For the last 30 years, Mr. Chambers has been associated with Qualcast (Ealing Park), Limited, firstly as metallurgist and since 1937 as works manager and director in charge of production. Prior to joining High Wycombe Foundry four years ago, Mr. Everett was for 18 years on the staff of Crompton Parkinson, Limited, Chelmsford.

News in Brief

THE Federation of Light Metal Smelters announces that its members' average selling prices for March were:—LM1, £154 10s. per ton; LM2, £161 10s.; LM4, £183; LM6, £204.

THE ABRAHAM DARBY FURNACE at Coalbrookdale, which in 1779 produced the castings for the historic bridge over the River Severn at Ironbridge, has been recommended as an industrial monument.

AS A RESULT of continued expansion in Europe and in order to offer the German market the best possible service, George Kent, Limited, Luton, announce that a branch office is to be established at 54, Westparkstrasse, Krefeld.

AMONGST BRITISH EXHIBITORS at the tenth Liège International Fair, held in Belgium from May 10 to 26, were R. J. Fleming & British-American Optical Industries, Limited, London, E.C.1; Safety Products, Limited, Redhill; Suffolk Iron Foundry (1920), Limited, Stowmarket; and Wolf Electric Tools, Limited, London, W.5.

THE EASTERN REGION of the British Transport Commission has placed a contract with the Goole Shipbuilding & Repairing Company, Limited, for a single-screw diesel-propelled grab hopper dredger to be used at Harwich. The main engines will be supplied by Ruston & Hornsby, Limited, Lincoln, and the grab crane by Priestman Bros., Limited, Hull.

OVER 500 MANUAL WORKERS employed by Coneygre Foundry, Limited, Tipton, one of the largest manufacturers of car castings in Tipton, began a four-day week this week. This has been brought about as a result of the strike of Swindon sheet-metal workers, which has affected many of the country's car-producing firms. Two weeks ago the same firm were forced to declare 70 of its employees redundant for the same reason.

A SALES TEAM of three from Sir W. G. Armstrong Whitworth (Aircraft), Limited, of Coventry, left on June 1 for South America taking with them the latest models of the A.W 650 Freightercoach and other versions in the series. Leading the team is Mr. C. S. Emery, sales director, and the other members are Mr. D. L. Raffle, the company's chief performance engineer, and Mr. Michael Spanyol, assistant to the civil aircraft adviser in the company's London office.

A SYMPOSIUM ON ALUMINIUM IN PACKAGING, arranged by the Aluminium Development Association, will be held at the Savoy Hotel on Thursday, June 12. The discussion will be in two sessions under the chairmanship, in the morning, of the president of the Association, Mr. S. E. Clotworthy, B.SC., M.I.E.E. (managing director, Northern Aluminium Company, Limited), and, in the afternoon, of Dr. Maurice Cook, F.I.M. (chairman, Imperial Chemical Industries, Limited (metals division)).

INDUSTRY IN THE MIDLANDS is keeping up its level of prosperity it was reported at a meeting last month, of the Regional Board for Industry. Mr. Stephen Burman, acting chairman, said that there appeared to be no appreciable slackening off in industry in the region as a whole, but certain companies and trades felt that it may be only just round the corner. Employment figures, he said, showed there had been no significant change in the industrial position in the Midlands.

THE GEORGE COHEN 600 GROUP is making excellent progress in important export markets. Their latest success story lies in selling cranes to eastern European countries; at the trade fairs of these countries their "Jones" cranes have been finding eager buyers. One in three of the cranes produced are going abroad, and more than half of the group's Colechester lathes are being exported. Last year, in the United States, Canada, and South America, sales of the lathes amounted to $3,000,000, The firm's motto is "keen prices, eager salesmen, and quick local service."

A MEETING OF MEMBERS of the Association of Bronze & Brass Founders in the London area is to be held at the Clarendon Restaurant, Hammersmith, on Wednesday, June 11. Commencing at 11.45 a.m. the first item on the agenda is a report and discussion of the Association's activities, which will continue until luncheon at 1 p.m. The meeting will recommence at 2.15 p.m. with the showing of three films entitled "Hand and Machine Moulding," "After the Shake-out" and "New Ideas at Work in the Foundry." These will be introduced by Mr. Frank Hudson.

THE CHEMICAL DIVISION of the Distillers Company, Limited, which provided the liquid carbon-dioxide bulk-storage and evaporation equipment for the first commercial atomic-power station at Calder Hall, has been responsible for the installation in the new station at Chapel Cross. The complete installation, designed by the company, includes five thermally-insulated bulk-storage tanks, each with a capacity of 20 tons of liquid carbon-dioxide and with a pressure-operated refrigerator and safety valves, together with six evaporators, each capable of vaporizing three tons of liquid carbon-dioxide per hour.

HEPWORTH & GRANDAGE, LIMITED, engineers, St. John's Works, Bradford, are to set up a £2,000 trust to provide prizes for successful students in the Diploma of Technology courses at the Bradford Institute of Technology. The money is the amount of contributions from friends of the late Mr. Elijah Hepworth, who died in January, 1957, and was chairman and managing director of the company and a director of the Associated Engineering Holdings, Limited. As no students will take the final examination for the Diploma for a further three years the money for the time being is to be invested. The prizes will probably be known as the Elijah Hepworth Memorial Prizes, and are likely to number three or four per year.

Dundee Works and Plant to be Sold

On June 18, machine tools and foundry plant of Wallace Foundry and Townshend Works, Dundee, are to be sold by auction. These establishments, together with Bellfield Works, were recently closed by Urquhart Lindsay & Robertson Orchar, Limited. The sale on June 18, is of plant and equipment surplus to requirements through concentration of work at Blackness Foundry, Dundee. Wallace Foundry, Townshend Works and Bellfield Works are to be sold. Henry Butcher & Company, auctioneers, London, are to conduct the sale, which will be at Townshend Works. The lots offered include lathes, milling machines, boring and turning mills, drilling machines, woodworking machinery, moulding equipment, mobile crane, office furniture, and canteen equipment.

Negative Required: Metal Porcelains, Limited, point out that in connection with the article on self-opacifying titania enamels appearing in the JOURNAL for May 22, on page 601, a vital "not" was omitted, which vitiated the meaning of a sentence. The relevant phrase should read ". . . and chipping or shaling has *not* been found to be a hazard in the field tests." Apologies are made to all who were confused by the error.

Obituary

V. DELPORT

The death was announced on Tuesday morning of Mr. V. Delport, director and treasurer of the Penton Publishing Company, Limited, London (the UK associate of the American publishing house of the same name). Since the early 1920's, Mr. Delport has been prominent in foundry circles, and has received meritorious services awards from the French, American and British foundry technical associations.

Mr. Delport was a graduate of the *Ecole Centrale des Arts et Manufactures*, in Paris, in 1913. He served with the French army in the first world war, and later joined the information department attached to the French High Commissioner in Washington. Following demobilization he joined the US Steel Products Company, first in New York and then in the Paris office. He was a consulting engineer, with Paris headquarters, from 1921 to 1924, at which time he became managing director of the Penton Publishing Company, Limited. Since 1926, he had been the European delegate of the American Foundrymen's Society to the International Committee of Foundry Technical Associations, of which he was president in 1937 and treasurer from 1956. He recently received a "citation award" made by the AFS in recognition of distinguished service, especially in connection with international foundry congresses. He was also made an honorary member of the *Association Technique de Fonderie* in recognition of his services to them. His membership of the London branch of the Institute of British Foundrymen dated from 1925, and he was a past-president of the branch and a General Council member for many years. From 1941 to 1946 he was secretary of the Council of Ironfoundry Associations, in the foundation of which he co-operated. He was also a member of the Iron and Steel Institute, the Institute of Metals, and the *Société Française de Metallurgie*. Mr. Delport will long be remembered as one who rendered unstinting service to the foundry industry over many years.

The death is announced at the age of 53 of Mr. NEVILLE LEETHAM, an inspector at Rolls-Royce, Limited, Derby.

The death is reported of Mr. ANDREW STARK, works manager of Shaw Glasgow, Limited, ironfounders, Maryhill Iron Works, Glasgow, N.W. Mr. Stark had been with the company for 20 years, and had spent the whole of his working life in the foundry industry.

The death has occurred of Mr. A. C. WILDSMITH at the age of 68. Mr. Wildsmith who recently retired from the staff of Thomas Brook & Sons, Limited, engineers, Huddersfield, was previously a director and secretary of Alfred Mellor & Sons, Limited, Huddersfield.

The foundry industry will learn with a sense of shock of the sudden death on Saturday last at the age of 34, of Mr. JOHN COLLETT, training officer of the Council of Ironfoundry Associations and honorary secretary of the organizing committee, representing the iron, steel and non-ferrous sections of the industry, which is arranging for the British entries in the European Foundry Apprentice Competition in Paris next autumn. Mr. Collett died at his home at Oxhey, Herts. Appointed training officer of the CFA early in 1955, he had displayed considerable drive and energy in carrying out the ironfounding industry's training policy at all levels. During the war Mr. Collett served in the Royal Air Force, and was awarded the Distinguished Flying Medal. He was an M.A. of Cambridge University.

Increases in Capital

POLMARK, LIMITED, engineers, etc., of London, W.12, increased by £50,000, in £1 shares, beyond the registered capital of £50,000.

BAINBRIDGE BROS. (ENGINEERS), LIMITED, Bury, increased by £20,000, in £1 ordinary shares, beyond the registered capital of £20,000.

RUFFWELL ENGINEERING COMPANY, LIMITED, Lansdowne, Bournemouth, increased by £11,850, in £1 ordinary shares, beyond the registered capital of £150.

BRITISH "REMA" MANUFACTURING COMPANY, LIMITED, Sheffield, increased by £30,000, in £1 ordinary shares, beyond the registered capital of £20,000.

RICARDO & COMPANY, ENGINEERS (1927), LIMITED, London, S.W.1, increased by £37,000, in 1s. founders shares, beyond the registered capital of £63,000.

GENERAL CABLE MANUFACTURING COMPANY, LIMITED, London, S.W.1, increased by £75,000, in 5s. ordinary shares, beyond the registered capital of £250,000.

B. DIXON-BATE, LIMITED, general engineers, etc., Chester, increased by £30,000, in £1 ordinary shares, beyond the registered capital of £20,000.

SOUTH DURHAM STEEL & IRON COMPANY, LIMITED, Middlesbrough, increased by £6,000,000, in £1 unclassified shares, beyond the registered capital of £12,000,000.

NORTHERN ALUMINIUM COMPANY, LIMITED, London, W.C.2, increased by £1,500,000, in £1 ordinary shares, beyond the registered capital of £3,500,000.

Changes of Name

Among companies which have recently changed their names are those listed below. The new titles are given in parentheses.

COVENTRY BRACE COMPANY, LIMITED, 25, Pall Mall, Manchester, 2 (Covath, Limited).

T. MILLER, LIMITED, 42-6, Hagley Road, Birmingham, 16 (T.M. (Metals), Limited).

ROWMILL METALS, LIMITED, 42-6, Hagley Road, Birmingham, 16 (R.M. (Metals), Limited).

COMPOSITE FORGINGS, LIMITED, Luton Road, Dunstable, Bedfordshire (Auto Body Dies, Limited).

SCOTWELL ENGINEERING, LIMITED, 10, Dunraven Place, Bridgend (Bridgend Engineering, Limited).

CAMOY (ENGINEERS), LIMITED, 12, Grey Street, Newcastle-upon-Tyne (Maccarthy (Industrials), Limited).

FILDOR, LIMITED, Queens House, Leicester Square, London, W.C.2 (Fildor Engineering & Equipment, Limited).

BROOKS, FORD & COMPANY, LIMITED, Collingwood House, West Hartlepool (Production Tools (Northern), Limited).

FINAQUIN, LIMITED, engineers, etc., of 10-13, Dominion Street, London, E.C.2 (Griss Engineering Products, Limited).

INDUSTRIAL PLANT & FUELS, LIMITED, 362, Glossop Road, Sheffield, 10 (Industrial Plant (Combustion), Limited).

T. ARNELL & COMPANY, LIMITED, 1, Holly Road, Twickenham, Middx (Twickenham Tool & Gauge Company, Limited).

L. ADAMS, LIMITED, mechanical and electrical engineers, etc., of 73/8, High Holborn, London, W.C.1 (Samlad, Limited).

SAMLAD, LIMITED, mechanical and electrical engineers, etc., of 73/8, High Holborn, London, W.C.1 (L. Adams, Limited).

YORKSHIRE COPPER WORKS, LIMITED, Hough Park Road, Stourton, Leeds (Yorkshire Copper Works (Holdings), Limited).

ASSOCIATED ENGINEERING HOLDINGS, LIMITED, Cleveland Place, King Street, London, S.W.1 (Associated Engineering, Limited).

METADUCTS, LIMITED, sheet-metal workers, etc., of 3, Catherine Wheel Road, Brentford, Middx (M.D. (Fabrications), Limited).

TRENISTREET FACTORS, LIMITED, Browns Buildings, Great Eastern Street, London, E.C.2 (Brown Bros. (Metals), Limited).

JOHN FOLKES (LYE FORGE) LIMITED, forgemasters and general engineers, etc., of Stourbridge (John Folkes Group, Limited).

TRIUMPH ENGINEERING COMPANY, LIMITED—Mr. William Winters has joined the board as works director. He succeeds Mr. R. J. Fearon, a director since 1950, who for the past two years has been acting in this capacity both for the Triumph and BSA factories. Mr. Fearon is now concentrating his efforts with BSA.

GAS PURIFICATION & CHEMICAL COMPANY, LIMITED—Mr. D. D. Mathieson has relinquished the chairmanship of the company and is now vice-chairman, that position having been vacated by Mr. Rossiter. At the recent extra-ordinary general meeting of the company, Vice-Admiral Sir Charles Hughes Hallett and Mr. W. J. Arris were elected directors; following the meeting Sir Charles was elected chairman.

Exhibition Briefs

Chemical and Petroleum Engineering

The Chemical and Petroleum Engineering Exhibition will be held at Olympia, London, between June 18-28 *(Sunday, June* 22, *excepted) and will be open to the public* 10 *a.m. to* 6.0 *p.m. on each of those days. Among exhibitors whose stands may be of interest to foundrymen are the following.*

TALBOT STEAD TUBE COMPANY, LIMITED, of Green Lane, Walsall, will be showing (*Stand* 7, *Row A*) a range of heat- and corrosion-resisting tubes, fittings, valves and other components from their range.

GRIFFIN & GEORGE, LIMITED, of Wembley, Middlesex (*Stand* 19, *Inner Row Gallery, Grand Hall*), will show scientific instruments and laboratory apparatus, laboratory furniture in wood and metal, and all ancillary laboratory equipment. The company are specialists in the equipping of the laboratories for technical instruction, industrial control and research.

THE DAVID BROWN COMPANIES (*Stand* 6, *Row M*), will be showing a 24-in. oil pipeline valve of a type previously manufactured only in the USA. Exhibited on behalf of the David Brown Foundries Division, Penistone, near Sheffield, the valve is one of several sizes which are being made to the order of the W.K.M. Valve Company (Britain), Limited, for use by the Shell Petroleum Company in Veñezuela.

MUREX WELDING PROCESSES, LIMITED, Waltham Cross, Herts (*Stand* 8, *Row J*), will show a selection of the latest equipment, electrodes and accessories for metal-arc welding of special interest to the chemical and petroleum industries. Among the exhibits will be their new high-speed pipe welding electrode, "Fastex 100" hand-welding electrode, which has been developed for the welding of pipe joints, for example, in cast/weld constructions.

J. STONE & COMPANY (CHARLTON), LIMITED, of Charlton, London, S.E.7, (*Stand* 18) will exhibit a series of non-ferrous alloys based on copper, manganese and aluminium. They are sold under the brand name "Superston." The exhibit is to be devoted to the company's castings and wrought products as supplied to the oil, chemical and marine industries. Castings for pumps and wrought products for heat exchangers are typical, and examples of welds will also be shown.

THE KESTNER EVAPORATOR & ENGINEERING COMPANY, LIMITED, of London, will exhibit a variety of chemical and allied plant (*Stand No.* 10, *Row E*) which will occupy a total superficial area of 1,400 sq. ft., some in operation and some static. A special item will be a full-scale Kestner Patent evaporator handling sulphuric acid leaving the hardening baths used in the manufacture of transparent paper.

THE POWER-GAS CORPORATION, LIMITED, of Stockton-on-Tees, England, will represent the Power-Gas Group together with Ashmore, Benson, Pease & Company, and Rose, Downs & Thompson, Limited (*Stand No.* 3, *Row K, ground floor*). Principal items of equipment on exhibition will be a heat exchanger, 21-ft. long, for use in a petroleum refinery, sample welds from a variety of metals including mild and special steels, machined castings and a pressure-tested stainless-steel pipework.

THE UNITED STEEL COMPANIES, LIMITED, of Sheffield, founder members of the Council of British Manufacturers of Petroleum Equipment, are showing typical examples of their steel products supplied to the chemical and petroleum industries (*Stand N*4). An interesting example of the company's research work is displayed in a flow diagram of fuel and air in an open-hearth furnace, the first furnace to be constructed on the basis of many years of aerodynamic study conducted by the company's research and development department.

GEORGE KENT, LIMITED, Luton, Bedfordshire, will devote the greater part of their stand to the "Commander" range of instrumentation, one section of which gives a practical demonstration of the interchangeability of the standardized units and assemblies from which this range of instruments is built up. The possible alternative combinations available in the range to-day total many hundreds of thousands so custom-built instruments from standardized components are available to users. An advantage claimed for this method of construction and design is that as process methods improve or a plant expands, the user can either build up his own range of specialized instruments or add to those already in use the required additional units.

New Catalogues

Valves. Meynell & Sons, Limited, Montrose Street, Wolverhampton, have issued a new catalogue covering valves, plug cocks, and special fittings. As befits a 100-year-old concern, this publication is essentially business-like and devoid of frills. It carries dimensional drawings associated with technical data of the standard lines manufactured by the company. The pages, numbering 38, and mostly printed on one side, are carried in a loose-leaf binder; the drawings and letterpress are beautifully clear. It is interesting to note that this firm manufacture to American standard pipe-thread screwing.

Nylon Tubing. A catalogue (Issue 1) received from Tecalemit, Limited, Plymouth, covering the subject of nylon tubes, reminded the writer that some time ago enquiries were received in the JOURNAL office for core vents manufactured from materials of this type. The range available is from $\frac{1}{4}$- to $\frac{3}{4}$-in. in six sizes. No doubt some readers will ask for samples for experimental purposes.

Vertical Air Circulation Furnaces. Catalogue No. M.2B issued by Metalectric Furnaces, Limited, Cornwall Road, Smethwick 40, Staffs, replaces a previous bulletin issued by the company, No. M.2A. The new catalogue covers a line of heat-treatment furnaces such as are used by light-metal foundries, and other concerns, which find use for the batch-in-quantity plant necessitating air circulation. The plants shown are particularly well engineered to suit specific requirements.

Band Sawing and Filing Machines. The Midland Saw & Tool Company, Limited, Midsaw Works, Pope Street, Birmingham, 1, have issued four uniform catalogues each dealing with a specific type of saw and filing machine—the Standard; Minor; Tridaulic; and Deep Throat. With the passage of time, the basic machine has become more versatile, and a number of attachments are now available to widen the range of its potentialities.

FOLLOWING recent expansion of trade, the British Monorail Company, Limited, Chadderton (Lancs), has opened a new factory at Brighouse (Yorks). It is expected that the present staff of 150 will be increased to 500 within the next three years.

Company News

ARMSTRONG WHITWORTH (METAL INDUSTRIES), LIMITED—Final dividend of 7½ per cent., making 10 per cent. (same). CIC consent has been obtained to a proposed two-for-five free issue.

BAKER PERKINS, LIMITED, manufacturing engineers and iron, steel, and brass founders, of Peterborough—Prospects for the group for 1958 as a whole appear reasonable, apart from reservations about the American and Brazilian subsidiaries, Mr. A. I. Baker, chairman, tells shareholders. Although overall profits might be reduced by the American situation the board expects to be able to maintain a 10 per cent. dividend on the capital as increased by the recent "rights" issue.

ARMSTRONG SIDDELEY MOTORS, LIMITED—Rearrangements brought about by concentration on new civil projects has resulted in the absorbing of Armstrong Siddeley (Brockworth), Limited. Towards streamlining the resources of the two companies, the Brockworth plant will continue to manufacture and repair aero engines and, as well as making the current range of Armstrong Siddeley diesel engines, will shortly manufacture under licence the Maybach series of diesels.

HEAD, WRIGHTSON & COMPANY, LIMITED—The company is raising the dividend by the equivalent of 2½ per cent. with a 12½ per cent. final for the year ended January 31, 1958. The group trading profit on completed work expanded from £1,446,163 to £1,735,422. There is added £22,159 (£20,758) received as interest and dividends. From the balance of £1,757,581 (£1,466,921) is deducted depreciation £199,433 (£169,045) and tax £835,574 (£675,226), leaving a group net profit of £722,574, against £622,650.

PLATT BROS. & COMPANY (HOLDINGS), LIMITED, textile and general engineers, of Oldham (Lancs)—A final dividend of 11 per cent. makes 15 per cent. for 1957 on capital increased after reorganization. Group net profit attributable to the holding company has increased to £796,054 (£300,583), after a substantially higher tax charge of £1,067,428 (£698,290). During the year Textile Machinery Makers, Limited, Tweedales & Smalley, Limited, and Prince-Smith & Stells, Limited, became wholly-owned subsidiaries and controlling interests were acquired in Hayward Tyler & Company, Limited, Le Grand, Sutcliff & Gell, Limited, and Epsylon Industries, Limited.

Recent Wills

DILLOWAY, H. J., of Gloucester, metal merchant ...	£24,361
GIBBS, LEONARD, formerly a director of Tube Investments, Limited	90,338
RALPHS, W. G., of Wednesfield, Wolverhampton, retired patternmaker	£11,137
FRANKLIN, E. S., for many years joint managing director of Stothert & Pitt, Limited, engineers and ironfounders, etc., of Bath (Som)	£34,287
MASON, CAPT. W. H., chief of the wagon control section of British Railways in Hull	£3,188
LEIVERS, A. E., chairman of Gent & Company, Limited, manufacturing electrical engineers, of Leicester	£128,570
LENCH, A. W., director of Thos. Wm. Lench, Limited, manufacturers of rivets, screws, etc., of Blackheath (Staffs)	£82,222
LEWIS, FRANK, managing director of W. J. Bridgwater & Company, Limited, iron, steel, and pig-iron merchants, of Dudley (Worcs)	£4,230
CHALMERS, G. W., formerly managing director of Hurst, Nelson & Company, Limited, designers and manufacturers of railway rolling stock and components	£19,404
GIBB, SIR ALEXANDER, founder of the firm of consulting engineers, Sir Alexander Gibb & Partners, distinguished member of many learned and technical societies	£77,606

Law Case

Tapping Machine "Repeated"

A female machine operator at the Rugby works of the British Thomson-Houston Company, Limited, was awarded £175 damages at Rugby County Court for injuries to her right index finger. The plaintiff, Miss Irene Adelaide Millard, alleged that when operating a tapping machine the tapping tool came down, the machine having started of its own accord. There was no guard on the machine.

For the company Mr. A. W. M. Davies submitted that the machine was not dangerous to the extent that it required a guard for the operator and that the real cause of the accident was Miss Millard's own negligence. There was no statutory breach on the part of the company, he maintained.

Giving judgment, Judge Hamilton said he was satisfied that the tap was a dangerous part of the machine and that it was not fenced according to Act of Parliament. He also found that contributory negligence on the part of Miss Millard had not been proved and he accepted her evidence regarding the machine "repeating."

Obligations of Employees

Workpeople should remember that the Factories Act imposes obligations on them as well as on their employers, said Mr. J. Leslie Hobson, deputy superintending inspector of factories, prosecuting at Sheffield, William Murdoch, an engineer at Stanley Works (Great Britain), Limited. Murdoch, who admitted contravening the Factories Act by wilfully interfering with a safety appliance, was conditionally discharged and ordered to pay 5s. costs.

Mr. Hobson said that if accidents were to be avoided it was essential that operators made proper use of safety devices. It was well known that they frequently failed to use guards. Murdoch, in an effort to increase production, unscrewed the guard on a "highly dangerous" power press. Later his hand was caught in the unguarded machine and his left index finger was amputated.

The defendant had already suffered greatly and the proceedings had been brought with great reluctance. A financial penalty was not sought, said Mr. Hobson.

"Shocking Delays"

Before giving judgment in a claim for damages at Newcastle-upon-Tyne Assizes, Mr. Justice Salmon suggested that trade unions ought to overhaul their machinery to ensure that cases in which they were involved came to trial more expeditiously.

He dismissed an action for damages brought by Mr. Joseph Mills Pratt against Armstrong Whitworth (Metal Industries), Limited. Mr. Pratt stated that he had strained his back lifting a heavy piece of machinery, but one of his workmates, called on his behalf, said that the plaintiff had never lifted the object.

"The union should have brought this case to trial a long time ago," said the judge. "In my view these delays are shocking."

IN ADDITION TO ORDERS worth £650,000 already placed with Leyland Motors, Limited, the Ceylon Transport Board has placed a further £250,000 contract.

THE ONLY REMAINING IRONFOUNDRY in Bacup (Lancs)—Robert Hardman & Bros. (Rockliffe), Limited—celebrates its centenary this year. The firm was founded by two brothers Hardman who were dissuaded from joining the California gold rush by their mother, who gave them money to start in business on their own.

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Raw Material Markets

Iron and Steel

Business at many foundries is scarce, and at the light foundries, in particular, capacity is available to undertake a much larger tonnage of castings than present orders provide. Plants cannot be kept fully occupied, and for the orders which arise there is keen competition.

Forward buying is negligible and prospects are not very bright, unless there is an easing of the credit restrictions, which would possibly bring an increased demand for castings from the building and domestic equipment trades as well as from other users of castings. Many of the jobbing foundries are in need of work, and most of the textile foundries are only moderately employed.

The consumers of high-phosphorus pig-iron continue to specify meagre quantities, and although outputs of this grade are on a reduced scale, available supplies are much in excess of demands. The furnaces are carrying in stock the excess quantities which arise, as the foundries are calling for only those tonnages which are needed to implement the work on hand, in view of the present economic restrictions and uncertainties.

Despite the adverse affects of the recent strike, which held up supplies of pressings and bodies and curtailed the production of engines at some establishments, the requirements of the motor-car industry for castings continue at appreciable levels. The automobile manufacturers are absorbing large tonnages of the low-phosphorus irons, together with good quantities of hematite and some refined irons, and the foundries making high-duty castings for other trades are also able to take up good tonnages to fulfill orders in hand. The supply of all of these irons is satisfactory and adequate to meet present demands.

All grades of foundry iron and hematite are available for export, but orders are difficult to obtain, as competition from overseas producers grows keener daily.

The foundries have plentiful supplies of scrap in all grades, and foundry coke deliveries are satisfactory.

The improvement in home supplies of semi-finished steel had cut back imports to negligible proportions. As in the case of basic pig-iron, the supply position is one of self-sufficiency.

Happily, the reduced calls for the lighter steel products has only, as yet, touched the fringe of the industry in terms of unemployment or shorter-time working. The backbone, in the shape of a still strong demand for heavier products, remains firm and, although buyers do not now find it necessary to book their orders so far ahead, rolling mills producing heavy sections, plate and sheets can point to work schedules sufficient to keep them well employed.

Non-ferrous Metals

Copper continues firm in London. The resumption of work at Chuquicamata had little or no effect on the market, not only because the loss of production entailed by the strike, estimated at around 35,000 tons, cannot easily be made up, but also because of the announced cut backs in production by the big US producers, Phelps Dodge Corporation and the Anaconda Company. Indeed, these latest voluntary reductions in production, lowering as they do Anaconda's annual rate of output to about 80 per cent. of that for last year and Phelps Dodge's to about 60 per cent., virtually ensure that the US price will not fall further. In this connection it is more than interesting to note that the further rise last week in the US custom smelter price by ¼ cent to 24¼ cents per lb. has found satisfactory support. The rise in the custom smelter price was followed by a similar rise in the Belgian price and both of these movements helped the LME price to stay above £180 a ton. On Tuesday there was a further increase of ¼ cent, bringing the US custom smelter price to 24½ cents. At the same time, activity in London has been good and stocks at the end of last week declined by 330 tons to 16,477 tons.

While predictions from America are more or less in agreement that the recession is flattening out, the non-ferrous metals consumption picture still remains disappointing. Copper is no exception and products shipped from brass mills, wire mills, and foundries during April were at their lowest level since last July. In Europe, the French situation is a restraining influence, but sellers are scarce and the undertone is firm.

The tin market is still under a cloud. The buffer stock manager has been absorbing more metal at the support price of £730 a ton and immediate relief from this position is not in sight. The market is not helped by the flow of Russian metal, nor was it aided by the temporary suspension of French import licences for the metal. At the end of last week stocks of tin in LME warehouses totalled 18,874 tons, a rise of 411 tons on the week. In the United States the market is quiet, with the price holding around 94½ cents per lb.

Lead has been quiet in London and idle in New York. The chief influence on this market at present is the news that stockpiling comes to an end with the submission of last month's tenders. To this must be added the poor outlook for the US automobile industry and the steady inflow of foreign metal, all of which pointed to a further reduction in price. The US quotation is ½ cent lower at 11 cents per lb.

In zinc, the major news item is the second cut in zinc production in six weeks by the New Jersey Zinc Company. The latest reduction lowers production to about 50 per cent. of the company's capacity. The news helped sentiment and the price in London.

Scotland and the Clean Air Problem

Some idea of the need for combating the smoke problem in Glasgow was given by Mr. Ian Robertson, of the Department of Health for Scotland, at the opening session of the Scottish division of the National Society for Clean Air on Thursday, May 22. In the centre of the city in the winter, he said, about 19 tons of soluble and insoluble matter were deposited per square mile per month.

The Glasgow Corporation planned to start with an area of 201 acres in the centre of the city and, assuming the Order was made, it was further planned to strike out boldly and cut across the city a great strip in which the emission of smoke would be controlled.

Prices of Basic Materials Still Falling

Cuts in steel prices at the end of March are reflected in the Board of Trade's basic materials prices index for April. The index is provisionally set at 93.9 (1954=100), compared with 94.8 in March and 110.2 a year ago. Prices for industry's basic materials continued to fall—a trend which has now lasted 12 months. Aluminium prices also fell, but the metal price cuts had only a slight total effect on materials for engineering.

Wholesale prices for engineering products have been largely unaltered for the past six months and the index for all manufactures was, at 112.4 for April, slightly lower than in March and only 1.8 points up on April, 1957.

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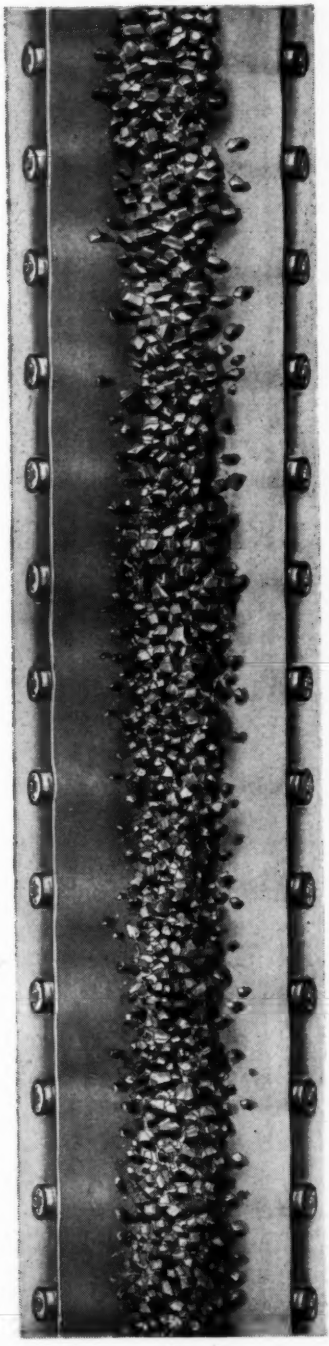

GOODYEAR

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Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

June 4, 1958

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £21 6s. 0d.; Birmingham, £20 18s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £23 17s. 0d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £24 1s. 3d.

Scotch Iron.—No. 3 foundry, £25 3s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £25 19s. 0d.; South Zone, £26 1s. 6d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £27 6s. 6d.; South Zone, £27 9s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. of England (local iron), £25 6s. 6d.; Scotland (Scotch iron), Zone S.1, £25 13s. 0d.; Sheffield, £26 15s. 0d.; Birmingham, £27 4s. 0d.; Wales (Welsh iron), £25 6s. 6d.

Basic Pig-iron.—£20 3s. 0d., delivered Staffs, Derbyshire, Notts, Lincs, Rutland, Northants, and Leics.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered)

Ferro-silicon (6-ton lots and over).—45 per cent. Si, £47 10s. 0d. to £48 0s. 0d., scale 17s. 0d. per unit; 75 per cent. Si, £67 0s. 0d. to £67 10s. 0d., scale 17s. 0d. per unit.

Ferro-vanadium.—50/60 per cent., 22s. 6d. per lb. of V.

Ferro-molybdenum.—65/70 per cent., carbon-free, 12s. 6d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., 2-3 per cent. Cu, £250 0s. 0d.; 38/40 per cent., commercially carbon-free, £287 0s. 0d.

Ferro-tungsten.—80/85 per cent., 7s. 8d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 10s. 8d. per lb. of W.

Ferro-chrome (6-ton lots and over).—4/6 per cent. C, £91 10s. 0d., basis 60 per cent. Cr, scale 30s. 0d. to 30s. 6d., per unit; over 6 per cent. C, £87 10s. 0d., basis 60 per cent. Cr, scale 30s. 6d. per unit; 2 per cent. C,* 2s. 1d. to 1½d. per lb. Cr; 1 per cent. C,* 2s. 1½d. per lb. Cr; 0.15 per cent. C,* 2s. 2½d. per lb. Cr; 0.10 per cent. C,* 2s. 2¾d. per lb. Cr; 0.06 per cent. C,* 2s. 3d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 7s. 2¼d. to 7s. 9¼d. per lb.

Metallic Manganese.—94/96 per cent., carbon-free, £265 0s. 0d.; 96/98 per cent., £295 0s. 0d.

Ferro-columbium.—65/72 per cent., Nb + Ta, 19s. 9d. per lb., Nb + Ta.

Ferro-manganese (home).—78 per cent., £83 0s. 0d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft u.t., £32 15s. 6d.; tested, 0.08 to 0.33 per cent. C, £33 15s., 6d.; hard (0.41 to 0.60 per cent. C), £34 17s. 0d.; silico-manganese, £43 16s. 6d.; free-cutting, £36 14s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £41 1s. 0d.; silico-manganese, £44 4s. 0d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.33 per cent. C, £38 10s. 0d.; basic, hard, over 0.41 up to 0.60 per cent. C, £39 12s. 6d.; acid, up to 0.25 per cent. C, £43 4s. 0d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £42 2s. 0d.; boiler plates (N.-E. Coast), £44 12s. 0d.; floor plates (N.-E. Coast), £43 11s. 0d.; angles (N.-E. Coast), £39 16s. 6d.; joists (N.-E. Coast), £39 12s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., and flats, 5 in. wide and under, untested soft basic, 50 tons and over: £40 0s. 6d; under 10 tons to 4 tons, £40 18s. 0d.; under 4 tons to 2 tons, £41 3s. 0d.; hoop and strip, coils, £39 0s. 0d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g., £44 16s. 0d.; black sheets (hand mill), 24g., £58 14s. 6d.; galvanized corrugated sheets, 24g., £66 16s. 0d

Alloy Steel Bars.—1 in. dia. and up: Nickel, £68 10s. 0d.; nickel-chrome, £99 11s. 0d.; nickel-chrome-molybdenum; £111 19s. 0d.

NON-FERROUS METALS

Copper.—Cash, £184 5s. 0d. to £184 10s. 0d.; three months, £187 5s. 0d. to £187 10s. 0d.; settlement, £184 10s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 1s. 8½d. per lb.; rods, 207s. 9d. per cwt. basis; 20 s.w.g., 241s. 0d. per cwt.

Tin.—Cash, £730 0s. 0d. to £730 10s. 0d.; three months, £733 0s. 0d. to £733 10s. 0d.; settlement, £730 10s. 0d.

Lead (Refined Pig).—First half June, £71 10s. 0d. to £71 12s. 6d.; first half September, £72 0s. 0d. to £72 2s. 6d.

Zinc.—First half June, £63 0s. 0d. to £63 5s. 0d.; first half September, £63 5s. 0d. to £63 10s. 0d.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £96 0s. 0d.; rolled zinc (boiler plates), all English destinations, £93 15s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £83 10s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 1s. 5½d. per lb.; sheets to 10 w.g., 155s. 6d. per cwt.; wire, 2s. 3½d.; rolled metal, 155s. 6d. per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £129; B6 (85/15), —; BS249, —.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £168; HTB2 (38 tons), — ; HTB3 (48 tons), —.

Gunmetal.—BS1400, LG2 (85/5/5/5), £153; LG3 (86/7/5/2), £162; G1 (88/10/2/½), £221; (88/10/2/1), £211.

Phosphor Bronze.—BS1400, PB1 (AID released), £240 per ton.

Phosphor Bronze Strip, etc.—Strip, 234s. 3d. per cwt.; wire, 3s. 6½d. per lb.; rods, 2s. 10½d.; tubes, 2s. 10½d.; chill cast bars: solids 2s. 9¾d.; cored 2s. 10¾d. (CHARLES CLIFFORD, LIMITED.)

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 5d. per lb.; round wire, 10g. in coils (10 per cent.), 3s. 9¼d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 3s. 8¼d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 5½d. per lb. Antimony, English, 99 per cent., £190 0s. 0d. Quicksilver, ex-warehouse, £76 0s. 0d. Nickel, £600 0s. 0d. Aluminium ingots, £180 0s. 0d.; aluminium bronze (BS1400), AB1, £200; AB2. £217.

* Average 68-70 per cent.